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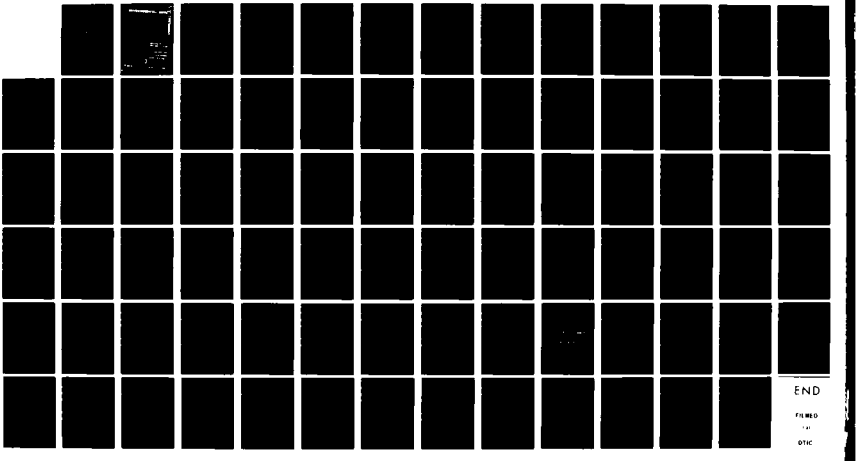

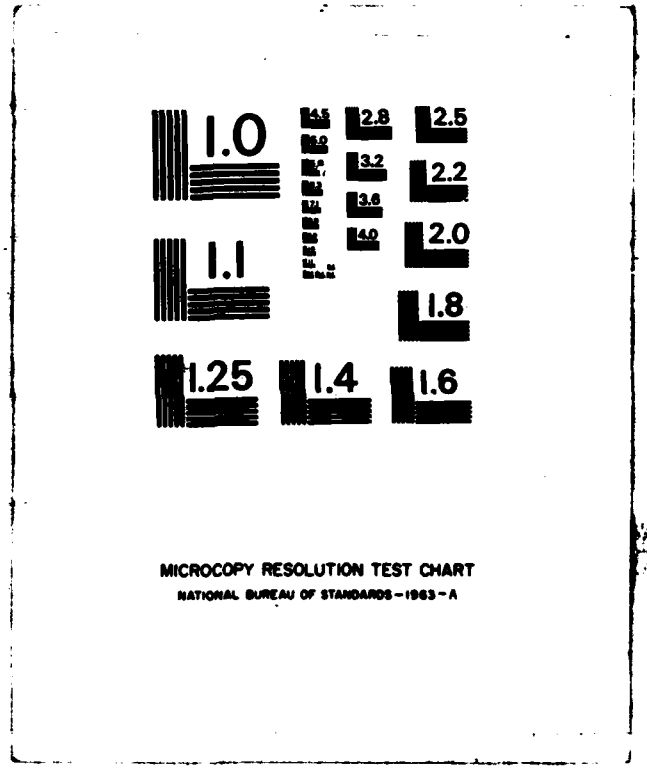
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ENVIRONMENTAL IMPACT STATEMENT

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SNAKE RIVER - MN

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REPORT DOCUMENTATION PAGE

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4. TITLE (and Subtitle) FINAL ENVIRONMENTAL IMPACT STATEMENT, SNAGGING, CLEARING, AND SHELTERBELT FOR FLOOD CONTROL, SNAKE RIVER, MINNESOTA.	5. TYPE OF REPORT & PERIOD COVERED Final EIS
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16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

See also Draft environmental impact statement, July 1979.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Environmental impact statements
Flood control
Snake River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The project would involve snagging and clearing of a 50-mile reach of the Snake River between its confluence with the Red River and the city of Warren, Minnesota. All non-rooted trees and snags in the primary channel would be removed. Standing timber within the primary channel would be cut within 6 inches of the ground. Pilings and rooted stumps in the wetted part of the channel would be cut as close to ground level as practicable. Shelterbelts would be planted along reaches of the river unprotected from drifting snow. This plan would

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reduce flood damages, prevent the reduction in channel capacity and the clogging effect of drifting snow, and increase the amount of riparian habitat. The loss of a large amount of aquatic and terrestrial habitat would occur along a 50-mile reach of the Snake River. The riparian wildlife community would suffer a loss in habitat valued for feeding, cover, perching or loafing, and movement corridors. Aquatic habitat lost would include areas important to the maintenance and protection of fish populations.

FINAL
ENVIRONMENTAL IMPACT STATEMENT
SNAGGING, CLEARING, AND SHELTERBELT FOR FLOOD CONTROL
SNAKE RIVER, MINNESOTA

ST. PAUL DISTRICT, CORPS OF ENGINEERS
1135 U.S. POST OFFICE AND CUSTOM HOUSE
ST. PAUL, MINNESOTA 55101

JANUARY 1982

SUMMARY

SNAGGING, CLEARING, AND SHELTERBELT FOR FLOOD CONTROL

SNAKE RIVER, MINNESOTA

( ) Draft Environmental Statement (X) Final Environmental Statement

Responsible Office: U.S. Army Engineer District, St. Paul, Minnesota

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: The project would involve snagging and clearing of a 50-mile reach of the Snake River between its confluence with the Red River and the city of Warren, Minnesota. All non-rooted trees and snags in the primary channel would be removed. Standing timber within the primary channel would be cut within 6 inches of the ground. Pilings and rooted stumps in the wetted part of the channel would be cut as close to ground level as practicable. All materials would be disposed of in the most environmentally acceptable way that meets State and Federal regulations. Also, suitable material would be made available for public use as cordwood.

Shelterbelts would be planted along reaches of the river unprotected from drifting snow. They would consist of a 3-row planting 30 feet wide. A variety of tree and shrub species that provides maximum height and density to the planting would be used.

3. Environmental Impacts

a. Favorable Environmental Impacts: The proposed Snake River plan would have some beneficial impacts in respect to flooding and development of wildlife habitat. Damages caused by the 3- to 5-year (33- to 20-percent chance) floods would be reduced as a result of the clearing and snagging. Shelterbelt construction would prevent the reduction in channel capacity and the clogging effect of drifting snow. There would also be an increase in the amount of riparian habitat as a result of the windbreak.

b. Adverse Environmental Effects: The loss of a large amount of aquatic and terrestrial habitat would occur along a 50-mile reach of the Snake River. The riparian wildlife community would suffer a loss in habitat valued for feeding, cover, perching or loafing, and movement corridors. Aquatic habitat lost would include areas important to the maintenance and production of fish populations. These areas are valued as a food source for some bird and mammal species as well as game fish of the Red River. The fishery also represents limited game fish populations. These would also be adversely affected.

4. Alternatives to the Proposed Project: No action, flood warning and emergency protection, flood insurance, flood proofing, floodplain regulation, evacuation, levee and floodway, channel modifications, diversion channel, upstream reservoirs, and snagging and clearing (proposed plan).

5. Comments Requested: Comments have been requested from the following (for a complete list of agencies, groups, and individuals who have been sent copies of the draft statement and from whom comments were requested see Section 9.00):

U.S. Environmental Protection Agency
U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Department of Energy
U.S. Department of Health, Education, and Welfare
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
U.S. Department of Transportation
State of Minnesota
Local Governments
Libraries
News Media
Interest Groups
Individuals

6. Draft EIS to EPA: 27 July 1979.

Final EIS to EPA:

FOREWORD

In response to a resolution adopted 11 May 1971 by the Middle River-Snake River Watershed District, Marshall County, Minnesota, the Corps of Engineers conducted an investigation to determine the feasibility of snagging and clearing obstructions from the Snake River for the purpose of flood control. This study is authorized under Section 205 of the 1948 Flood Control Act.

A reconnaissance report on the feasibility of providing flood control improvements for the Snake River was issued in August 1972.

The National Environmental Policy Act of 1969 (NEPA) states, in part, that it is the continuing responsibility of the Federal Government to use all practicable means consistent with other essential considerations of national policy to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may:

Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.

Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.

Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.

Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice.

Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities.

Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Further, with respect to major Federal actions significantly affecting the quality of the human environment, Section 102(2)(c) of the NEPA calls for preparation of a detailed statement on:

The environmental impact of the proposed action.

Any adverse environmental effects which cannot be avoided should the proposal be implemented.

Alternatives to the proposed action.

The relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity.

Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

In accordance with the requirements of the NEPA, the Corps prepared a draft environmental impact statement (EIS) and furnished it simultaneously to the U.S. Environmental Protection Agency, other concerned government agencies, and all known interested members of the public on 27 July 1979. The draft EIS was noted in the Federal Register on 3 August 1979, at which point a 45-day review period commenced. The purpose of that review period was to allow agencies and the public an opportunity to review the draft EIS and submit their comments.

All comments received on the draft EIS, along with Corps responses to them, are presented in this final EIS (See pages 51 and following).

The final EIS will be reviewed by higher Corps authorities and then furnished to the U.S. Environmental Protection Agency, other concerned government agencies at the Washington level, State and local government agencies, and members of the public. Following that distribution, a notice of the availability of the final EIS will appear in the Federal Register, at which point a final 30-day review period will commence. No official action will be taken on the proposed Snake River project until these steps have been completed.

Coordination in planning with all known interests is a continuing process and attempts to maintain this coordination are being made. (See Section 9 of this report for more detailed information.) Single copies of this report are available at the Corps of Engineers, St. Paul District Office, 1135 U.S. Post Office and Custom House, St. Paul, Minnesota 55101.

FINAL
ENVIRONMENTAL IMPACT STATEMENT
SNAGGING, CLEARING, AND SHELTERBELT FOR FLOOD CONTROL
SNAKE RIVER, MINNESOTA

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SNAKE RIVER, MINNESOTA

1.00 PROJECT DESCRIPTION

Project Location

1.01 The Snake River watershed is located in northwestern Minnesota in Marshall, Polk, and Pennington counties, with the majority of the 922-square-mile drainage area located in Marshall County. The project area of the Snake River traverses the intensively farmed, relatively flat Red River Valley. The study area itself covers a 50-mile reach of the Snake River, extending from its confluence with the Red River of the North to Warren, Minnesota, county seat of Marshall County. Alvarado, Minnesota, 11 miles west and 16 river miles downstream from Warren, is the only other community within the study area (Figure 1). The economies of both Warren (1970 population, 1,999) and Alvarado (1970 population, 302) are geared primarily to serving the needs of the surrounding agricultural areas. A map of the project area showing the proposed plan is shown in Figure 1.

Project Authorization

1.02 The proposed project provides for the snagging and clearing of approximately 50 miles of the Snake River. Also, shelterbelts would be constructed along selected areas of the river. The authority for this project is provided by Section 205 of the 1948 Flood Control Act. The proposed project could be completed in February 1983.

Project Purpose

1.03 The proposed project primarily would lessen the crop destruction, delayed planting, reduced yields, and other agricultural losses resulting from flooding within the Snake River drainage basin.

1.04 The project is expected to reduce flood damages by 17 percent and would be most effective for flood flows at or near channel capacity. It would lessen damages caused by 3-year floods (33 percent chance) and have progressively less effect on less frequent floods.

The Proposed Plan

1.05 The Snake River plan is composed of 2 major activities: clearing and snagging, and planting shelterbelts. The lower 50 miles of the river would be cleared of fallen timber and other debris which is obstructing the natural free-flowing capacity of the river. These activities would be conducted in the winter to facilitate access and reduce the ecological impacts. Shelterbelts would be planted along preselected, unprotected sections of the river and would function as barriers to the accumulation of large quantities of snow within the primary channel. The accumulation blocks the river channel, preventing the drainage of spring snow melt which in turn causes increased overland flows, increased leaching of nitrogen from the soil due to a longer duration of standing water, and delays in spring planting.

Clearing and Snagging

1.06 Within the river's primary channel, all snags and non-rooted fallen trees would be removed and deposed of. Fallen trees that are still rooted would be cut to a maximum height of 6 inches, as would trees in the lower two-thirds of the channel whose root systems have been undermined. Dead or leaning trees in immediate danger of falling into the channel would be cleared. Leaning trees which are still healthy, except those which deflect the current against an unprotected bank, would be preserved by a selective tree-marking program.

1.07 Dense stands of brush would be cut if the removal is hydraulically desirable and would not aggravate soil erosion. Brush removal would be selective and confined to the lower two-thirds of the channel banks. Brush would be cut as low as practicable but no higher than 6 inches above the ground.

1.08 All loose and uprooted stumps would be removed from the ice, as would those portions of partially submerged debris which are above the ice. Completely submerged stumps and debris would be left in place, as would root systems which aid in stabilizing the channel. Stumps from broken or previously cut trees along the channel would be cut to the same height above ground as standing trees. Any pilings encountered within the clearing limits would be cut as nearly flush to the ground or bottom of the channel as possible.

1.09 During the tree-marking program, the areas just above the primary channel would be inspected to see whether any areas along the sites would also need to be cleared. If any clearing is required, the first 10 feet on both sides would be cleared of any large floatable debris and fallen timber in danger of falling into the river channel. (Any debris or timber of lesser size or lying in a spot where it could be expected to lodge in surrounding vegetation rather than wash into the channel would not be cleared.) Live vegetation would not be cleared from this area.

1.10 Except for the reach of river through Warren (river miles 48 to 51), the river upstream from mile 20 has not been previously cleared. (See maps following page D-28 of the Detailed Project Report.) The reach between Alvarado and State Ditch 5 contains large amounts of debris and fallen timber which would require removal. The area between State Ditch 5 and the upstream clearing limits contains much less material that needs to be removed than the reach immediately downstream. Construction in the lower reach of the river (from the mouth to river mile 20) would consist of debris removal only, since this reach was cleared and snagged by the Middle River-Snake River Watershed District in 1969 and 1971 and does not require much work. (This project was funded by the State of Minnesota and the U.S. Office of Emergency Preparedness following the 1969 flood.) The snagging and clearing work would be continuous through all bridge sites within the limits of the contract work. All bridges would remain intact and be protected from any damage. Precautions would be exercised to prevent damage to existing side ditch inlets and road and field ditches along the rivers.

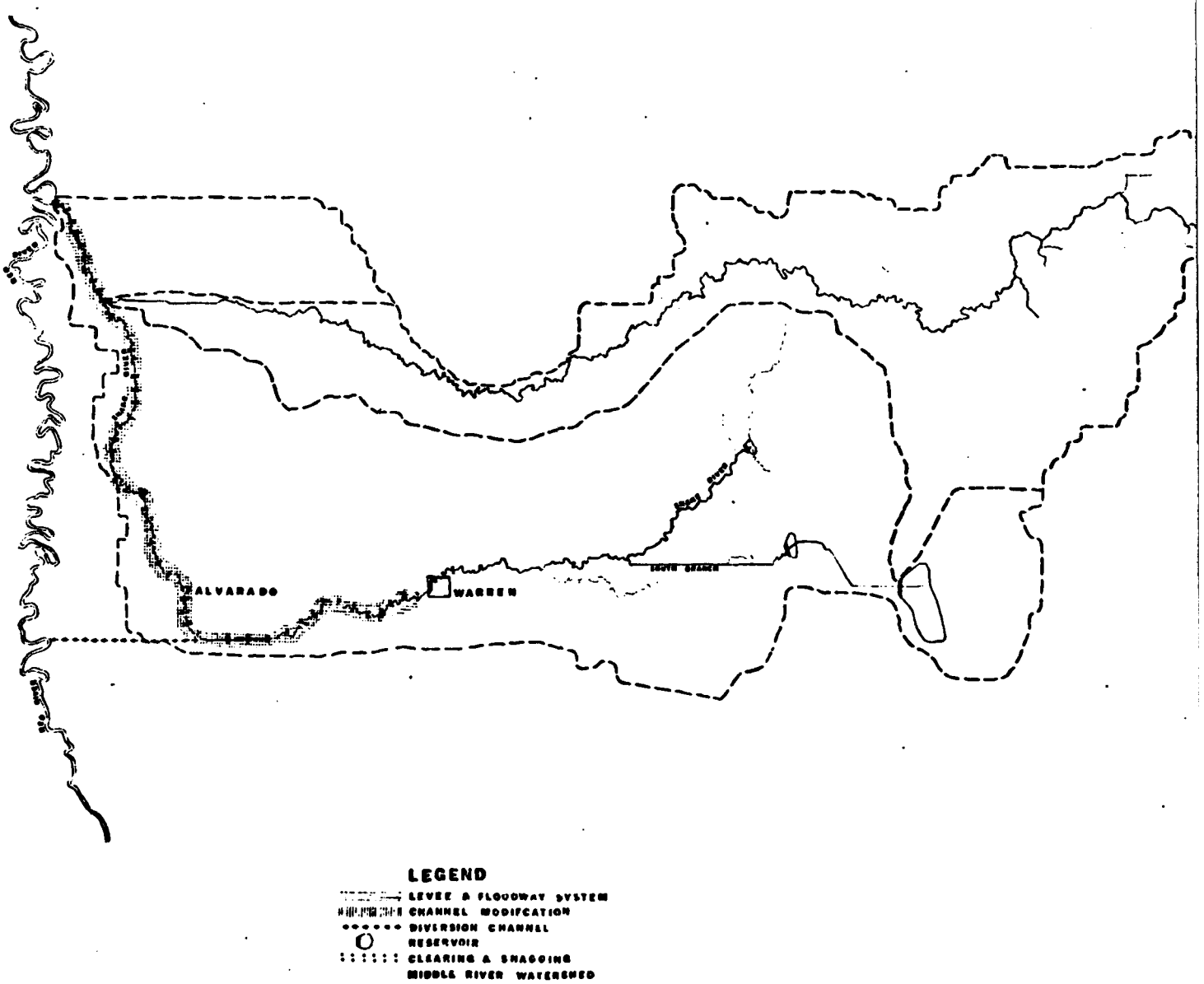

FIGURE 1. Flood Control - Snake River Alternatives Considered

* U.S.GPO:1979 665-055/23-6

Windbreaks

1.11 As part of the proposed plan, windbreaks would be planted at points along the river where the wooded corridor is not continuous and the unprotected channel becomes filled with snow, which hampers spring runoff and contributes to the overland flooding problem. These windbreaks would reduce windblown siltation and snow accumulations.

1.12 Shelterbelts would be planted parallel to the river, with the inner edge of the planting no less than 150 feet from the top of the channel (the minimum distance necessary to prevent channel drifting). The shelterbelts can be as far as 500 feet from the primary channel to accommodate agricultural use and to reduce the amount of land removed from production. Optimally, the windbreak should be four or more rows wide, planted on both sides of the channel, to obtain maximum benefits; but, due to local opposition to the amount of agricultural land lost under this plan, a compromise plan has been developed, with a three-row planting limited to the north side of the channel on the project reach between Warren and Alvarado. It should provide channel protection from northerly-blown (the prevalent wind direction) snow. There will be no protection from southerly storms or wind-blown snows.

1.13 Within the windbreak, rows would be 15 feet apart. Within the shrub rows, plantings would be 3 to 4 feet apart; within the tree rows, 10 feet apart. This spacing would provide an effective barrier against windblown snow, yet eliminate most of the natural pruning which occurs on plantings that are too close together (U.S. Department of Agriculture, 1964). The planting would be arranged so that the outer row (farthest from the channel) would include a combination of short trees, using box elder (Acer negundo), Russian olive (Elaeagnus angustifolia), and American plum (Prunus americana). The center row of the belt would be composed of a combination of shrub species, including Allegheny blackberry (Rubus allegheniensis), buffaloberry (Shepherdia argentea), chokecherry (Prunus virginiana), honeysuckle (Lonicera tartarica), and multiflora rose (Rosa multiflora). The inner row (closest to the river) would be a tall tree row composed of cottonwood (Populus deltoides) and green ash (Fraxinus pennsylvanica). Such a planting scheme maximizes the protective benefits of the belt, in addition to reducing the possibility of the belt being destroyed by a disease affecting a single species. Species composition would provide wildlife food and cover in an area where agricultural clearing has destroyed most of the natural habitat.

1.14 Identification of trees to be removed, access points, disposal areas, and access points for shelterbelt planting would be done during a preconstruction marking operation conducted by the Corps of Engineers. This operation would be conducted during the late fall, when logistics problems are at a minimum. It would insure that the removal of trees and shrubs, and the ecological impacts, are kept to a minimum.

Operation and Maintenance

1.15 The clearing and snagging operation would be conducted during the winter so that the river channel could be used as a base of operations. Contract specifications would require that the work be conducted from the ice except where conditions prove hazardous. If the project cannot be completed during the winter, it would be finished at times when there is no flow, which is sometimes the case with the Snake River. Summer removal may be necessary in heavily snagged areas, where an entire tree has fallen into the channel or a large portion of the debris is under the water surface. The dry channel would still be used as a base of operations.

1.16 The shelterbelt planting would be done in April or May, after the frost is out of the ground and before any new growth occurs on the trees to be planted.

1.17 The Minnesota Department of Natural Resources (MDNR) has proposed the purchase of a 100-acre tract of land, located between Alvarado and State Ditch 5 in Sections 8 and 17 of T. 154 N. and R. 49 W., to be maintained as a wildlife management area. The Snake River meanders through this area for about three-quarters of a mile. Project activities in this area would be limited to removal of debris and snags that are causing a serious impediment to the flow. This aspect of the project has been coordinated with the MDNR in the event that the land is acquired and their management plans implemented.

1.18 Materials and debris from the snagging and clearing operation would be removed from the site and disposed of in the most environmentally acceptable way. Salvageable material would be stockpiled where it would not interfere with existing land-use practices; and, in the interest of conservation, all suitable timber could be used to produce marketable saw-logs, posts, or cordwood. All unsalvageable material would be disposed of by burning (when and where allowable), burial, or hauling to an approved disposal site. Debris disposal would be accomplished in the manner most agreeable to the local landowners and in compliance with Federal, State, and local regulations. Members of the Snake River-Middle River Watershed District Board have commented that the demand for cordwood has markedly increased in recent years and they recommended that as much of the salvageable material as possible be made available for this use. The District Board also recommended that any salvageable materials from the downstream reaches of the river be stockpiled at a selected upland site to substantially remove it from the floodplain of the Red River of the North.

1.19 Maintenance of the flood-carrying capacity of the improved channels would be essential to assure effective operation of the overall drainage system and realization of the anticipated project benefits. To properly evaluate the condition of the river channel within the project limits, annual inspections are recommended as a minimum requirement. It is anticipated that debris removal may be required annually or after each flood event in some isolated reaches, and minor clearing of new growth required every 3 to 4 years in critical sections of the channel. Project maintenance would be the responsibility of local interests and is part of the local cooperation requirements discussed in the Detailed Project Report (on file at the St. Paul District Office).

Economics

1.20 The proposed project would result in estimated average benefits of $162,800 with the shelterbelts and $67,900 without the shelterbelts, yielding benefit-cost ratios of 2.4 and 2.2, respectively. Shelterbelt benefits reflect economic values but do not take into account the unquantifiable wildlife values of the windbreak planting. Benefit calculations are based on October 1978 prices, a 6-7/8 percent interest rate, and a 50-year period of amortization.

2.00 ENVIRONMENTAL SETTING WITHOUT THE PROJECT

Geographical Setting

2.01 The Snake River is a slow moving, meandering tributary of the Red River of the North, which drains an area of about 922 square miles in northwestern Minnesota and has a total length of over 80 miles. The Middle River drains into the Snake River about 5 miles above its mouth through State Ditch Number 3.

2.02 The Middle River and Snake River watersheds are located in southwest and westcentral Marshall County (768 square miles), in northwestern Pennington County (22 square miles), and in northwestern Polk County (132 square miles). An extensive system of ditches in the area, some of which drain into the Snake River, provides drainage for large expanses of land. Sometimes, during the summer months, the Snake River has intermittent flow.

2.03 The area is used almost entirely for agricultural purposes, but areas of woodland exist along the river.

Geology

2.04 This portion of Minnesota was affected by glacial action, and the watersheds of the Middle and Snake Rivers are within a featureless plain considered to have been submerged in ancient glacial Lake Agassiz about 10,000 years ago. The eastcentral part of the watershed is crossed by low ridges which are the remnants of the beaches of Lake Agassiz as it receded.

Topography

2.05 The lowest elevation in the watershed is at the mouth of the Snake River where the ground is about 765 feet above mean sea level. The higher elevations are found in the extreme northeastern portion of the Middle River watershed where some elevations slightly exceed 1,190 feet. The difference in elevation is 425 feet.

2.06 The slopes in the Middle and Snake River watersheds range from ½ foot per mile near the Red River to 2 feet per mile in the headwaters area. Near the Red River, slopes are slight, and the streams originally had no discernible channels, so artificial channels have been constructed across these flat areas. State Ditches 3 and 5 are early channels, constructed in this area about 1896.

Soils

2.07 Soils in the Snake River drainage basin are alluvial in the river bottoms, while the upland soils are predominantly the Fargo and Bearden soils series.[1]

---

[1]Soil Conservation Service, 1939 Reconnaissance Soil Survey of the Red River Valley Area, Minnesota.

2.08 Alluvial soils are undifferentiated and occur in long, narrow strips along the channels of streams. These soils range from clay to outwash sand and include loamy sands and silt loams, vary in color from black to light brown, and range in stoniness from an absence of stones to very stony. These areas are poorly drained; therefore, only portions are cultivated. Most of these areas are forested.

2.09 The Fargo soils have high clay and organic matter contents which cause a conspicuously heavy texture and a black-colored surface soil. The natural richness of these soils makes them well suited to agricultural purposes, and they are cultivated extensively.

2.10 The Bearden series consists of two principal types: loam and silt loam. These soils are not as naturally fertile as the Fargo soils but are still used extensively for agricultural purposes.

Climate

2.11 The climate of the Snake River basin is characterized by wide variations in temperature with moderate rainfall and snowfall. The mean annual precipitation averages 19.73 inches with snow accounting for about 2.6 inches of the total. The mean temperature is 38°F. Extreme temperatures recorded range from a high of 108°F to a low of -49°F. Frost-free days, as observed at the University of Minnesota Experiment Station at Crookston, Minnesota, average 124 days annually. The average date of the last frost in spring is 19 May, and of the first frost in fall, 20 September.

Water Quality

2.12 Analysis of water samples from the Snake River indicates moderate to high alkalinity and sulfate concentrations. A small percentage of the samples exhibited less than desirable dissolved oxygen concentrations. However, ionic constituents indicate generally good water quality with values typical of other surface waters in the same geographic areas (Table 1). The Snake River has received a Fisheries and Recreations use classification (2B) by the Minnesota Pollution Control Agency. A 2B classification describes water quality standards that will "permit the propagation and maintenance of cool or warm water sport or commercial fishes and be suitable for aquatic recreation of all kinds, including bathing..." (Table 2).

Water Supply

2.13 Small to moderate supplies of groundwater are available in the uplands in the eastern part of the basin. In the remainder of the basin, especially more westerly areas adjacent to the Red River of the North, suitable groundwater supplies are limited and inadequate. Surface waters seem to be the largest potential source of water for the Snake River basin, the best source of which appears to be the Red River of the North due to the intermittent characteristics of the Snake River and the nearby Middle River.

2.14 Use of the groundwater supplies is limited due to the high dissolved solids content, which renders such waters unsuitable for domestic uses.

Table 1 - Summary of Water Quality Data[1]

Item	Parameter										
	Fecal Coliform MPNECMED /100ML[2]	Turbidity (JTU)[3]	Total Alkalinity as $CaCO_3$ (Mg/L)	pH	Dissolved Oxygen (Mg/L)[4]	BOD[5] (Mg/L)	NO_3-N Total (Mg/L)[5]	Conductivity at 25°C (Micromho)	Chloride Cl (Mg/L)	Sulfate SO_4- Total (Mg/L)[6]	Calcium as $CaCO_3$ (Mg/L)
Number of Samples	28	28	28	27	27	28	28	28	28	12	27
Average Value	76	27	238	8.0	7.6	4.7	.31	600	32	75	155
Range of Values	20-700	3-170	93-560	7.4-8.9	.8-13.0	1.3-12.0	.5-280	270-1400	3-150	22-200	80-280

Notes:

[1] Source: Minnesota Pollution Control Agency. Data collected 1971-1974 on the Snake River, north of Big Woods.

[2] Most Probable Number EC Medium (MPNECMED). Limit of sensitivity is 20 units; average determined by using a value of 10 for samples below detection level. Three of 28 samples had a value higher than 200.

[3] Seven of 28 samples had a value higher than 25.

[4] Three of 27 samples had a value less than 5.0.

[5] Limit of sensitivity varied between .1 and .05; average determined by using a value of .05 and 0.25 respectively for samples below detection level.

[6] Two of 12 samples had a value higher than 100.

TABLE 2 - WATER QUALITY STANDARDS FOR SNAKE RIVER

2B CLASSIFICATION

Parameter	Limit
Dissolved Oxygen	not < 6 mg/l April 1 - May 30 not < 5 mg/l any other time
Temperature	5°F above natural[1] - streams 3°F above natural[1] - lakes
Ammonia (N)	1 mg/l
Chromium (Cr)	0.05 mg/l
Copper (Cu)	0.01 mg/l
Cyanides (NC)	0.02 mg/l
Oil	0.5 mg/l
pH	6.5 to 9.0
Phenols	0.01 mg/l
Turbidity	25 Jackson Units
Fecal coliform	200/100 ml of sample
Radioactive material	Not to exceed the lowest concentration permitted by the authority having control over their use.

[1]Minnesota Pollution Control Agency, Rules and Regulations, WPC 14, 4 October 1975. Based on monthly average of the maximum daily temperature except in no case shall the monthly average exceed the daily average temperature of 86 degrees Fahrenheit.

Wildlife Resources

2.15 The floodplain forests are prime habitat for many wildlife species. It is the preferred habitat for furbearers and other mammals. The bottomland woods also provide sanctuary for migrating birds as well as suitable habitat for permanent residents. The complexity and diversity of the wildlife resources are attributable to the area's water resources and vegetative composition, which have evolved with periodic flooding.

2.16 Fish - The fish resources of the Snake River are represented by a limited fishery composed of a small population of harvestable fish. These species are presumed to include silver and northern redhorse (Moxostoma anisurum and M. macrolepidotum), freshwater drum (Aplodinotus grunniens), quillback (Carpiodes cyprinus), mooneye (Hiodon tergisus), channel catfish (Ictalurus punctatus), and walleye pike (Stizostedion vitreum). The fish population may also include minnows, shiners, and other forage fish, which provide an input into the foodchain of the Red River of the North, thus providing a link between the Snake River's productivity and the fishery of the Red River.[1]

2.17 Mammals - White-tailed deer (Odocoileus virginianus) and an occasionally-sighted moose use the channel area as a movement corridor through the relatively barren agricultural areas, to some of the woodlots of higher habitat value. White-tail deer wintering yards, with 20 to 30 head each, are found near Alvarado and Warren. The predominant furbearers found in the river corridor include beaver (Castor canadensis), mink (Mustela vison), raccoon (Procyon lotor), and muskrat (Ondatra zibethicus). Other mammals found in the area include foxes (Vulpes vulpes and Urocyon cinereoargenteus), weasel (Mustela sp.), rabbit (Lepus townsendii, L. americanus, and Sylvilagus floridanus), skunk (Mephitis mephitis), and squirrel (Sciurus carolinensis, S. niger and Tamiasciurus hudsonicus). The more obscure mammals inhabitating the area include the mole (Condylura cristata), shrew (Sorex sp. and Microsorex hoyi), bat (Myotis sp., Lasionyctetris noctivagans, Eptesicus fuscus and Tasiurus sp.), ground squirrel (Spermophicus sp.), chipmunk (Tamias striatus), and mice (Cricetidae and Zapodidae families).

2.18 Within the heavily farmed and cleared land of the Snake River area, the diverse river bottom habitat provides a variety of food and cover types making available a multitude of different niches. Many of the species present are adapted to a certain role or niche within this complex ecosystem, each of these organisms being somewhat dependent on the other organisms, whether in predator-prey or energy flow relationships. It is important, especially in an area like the Snake River, to maintain and, if possible, to propagate these ecosystems that represent the natural productivity of our land.[2]

2.19 Birds - The U.S. Fish and Wildlife Service (FWS) has compiled a list of 101 avian species for the Snake River drainage basin. That list and the following information are provided in the 1980 FWS report, Terrestrial Resources for the Minnesota Portion of the Red River of the North Basin.

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[1] U.S. Fish and Wildlife Service. 1979. Aquatic Resources of Minnesota Tributaries to the Red River of the North.

[2] U.S. Fish and Wildlife Service. 1980. Terrestrial Resources for the Minnesota Portion of the Red River of the North Basin.

2.20 The Snake River area provides a diverse type of habitat for many different types of bird species. This diversity of habitats occurs in a horizontal plane starting at the river edge and moving through the various vegetative zones to the edge of the agricultural land. There is also a diversity found in a vertical plane. Different groups of bird species are associated within the different heights, types, and densities of shrub and tree vegetation. This makes the Snake River bottoms rich in bird life, as evidenced by the large number of species that are known to use the area.

Amphibians and Reptiles

2.21 The limited amphibian and reptile resources of the Snake River area are primarily represented by frogs, snakes, and turtles. The amphibian species would include the tiger salamander (Ambystoma tigrinum), Dakota and plains toads (Bufo hemiophrys and B. cognatus), grey tree frog (Hyla versicolor), leopard and wood frog (Rana pipens and R. sylvatica), and the chorus frog (Triseriota pseudocris). The reptiles found in the Snake River area would include the plains and common garter snakes (Thamnopl is sirtalis and T. radix), painted turtle (Chrysemys picta), and common snapping turtle (Chelydra serpentina).

2.22 Since the Snake River occasionally becomes dry in the summer, the amphibian and reptile life would be closely associated with beaver impoundments. Also, spring flooding would provide scattered pockets of temporary water that could be used by salamanders, toads, and frogs.[1]

Endangered Species

2.23 Endangered or threatened species which may be found in the project area are the Arctic peregrine falcon (endangered) and the grey wolf (threatened in Minnesota). The peregrine breeds in the treeless tundra area of Arctic Alaska, Canada, and western Greenland. Its migration routes go through middle and eastern North America. No sitings of Arctic peregrine falcons have been recorded in the project area. (U.S. Fish and Wildlife Service's, North Central Region "Red Book" for Threatened and Endangered Species, as amended September 1980.)

2.24 The range of the grey wolf extends through northeastern and north-central Minnesota. The project area lies on the periphery of this range. Wolves are normally found in the forested regions of Northern Minnesota. Presence of the grey wolf would be only occasional, if not unusual, in this extensively cleared, agricultural area.

Vegetation

2.25 The natural vegetation of the area is located primarily along the river, with some native woodlands and planted shelterbelts on farmsteads. The riparian overstory of the Snake River, similar to that of the Forest River in North Dakota[2], would include willow (Salix sp.), cottonwood, green ash, box elder, and American elm (Ulmus americana).

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[1]U.S. Fish and Wildlife Service. 1980. Terrestrial Resources for the Minnesota Portion of the Red River of the North Basin.

[2]Wilkum, D. A. and M. K. Wali, 1974. "Analysis of a North Dakota Gallery Forest; Vegetation in Relation to Topographic and Soil Gradients." Ecological Monographs 44:441-464.

2.26 Ordinarily a well-developed understory composed of small trees and shrubs is present in the floodplain forest. These would include prickly ash (Zanthoxylum americanum), dogwood (Cornus sp.), wolfberry (Symphoricarpos occidentalis), chokecherry, gooseberry (Ribes missouriensis), and wild grape (Vitis sp.), as well as several others.

2.27 Aquatic vegetation found within the Snake River watershed would include pond weeds (Potamogeton sp.), arrowheads (Sagittaria sp.), bulrush (Scirpus sp.), sedges (Carex sp.), and cattail (Typha latifolia).

Land Use

2.28 The majority of the land within Marshall, Polk, and Pennington Counties is devoted to agriculture (Table 3). Approximately 75 percent of the land in the watershed is devoted to agriculture, 15 percent to woodland, and the remaining 10 percent to farmsteads, roads, ditches, marshes, and other miscellaneous uses.

2.29 Land-use activities in this region have significantly altered the original landscape through wetland drainage, forest clearing, agricultural development, and urban expansion (Table 4). Most of the forests remaining are near farmsteads or along stream valleys.

Potential Land Use

2.30 The Minnesota DNR has proposed the acquisition of a tract of woodland upstream of Alvarado as a wildlife management area. About a three-quarter mile reach of the Snake River flows through the proposed wildlife management area.

2.31 A wildlife manager with the DNR has stated that this is a unique 100-acre tract of land. It is one of the last substantial stands of timber along a watercourse in the intensively cultivated Red River Valley.

2.32 Existing in this area is a wide diversity of tree species including bur oak (Quercus macrocarpa), elm, cottonwood, aspen (Populus sp.), balm of Gilead (Populus candicans), ironwood (Ostrya virginiana), ash (Fraxinus sp.), box elder, American plum, and black willow (Salix nigra). Farther away from the river a shrub layer is present consisting of chokecherry, raspberry (Rubus strigosus), and dogwood.

2.33 This area provides some of the best wildlife habitat within an 8-mile radius. Because of its size and good cover, it is a well-used deer wintering yard with approximately 30 deer annually congregating in the area. The area also provides preferred habitat for furbearers, squirrels, woodducks, and great horned owls plus several other mammalian and avian inhabitants.

Flooding

2.34 Floods causing significant damages in the city of Warren occurred in 1896, 1897, 1901, 1941, 1950, 1965, 1966, and 1969. The greatest flood of record occurred in 1969; however, a greater historical flood in 1897 probably exceeded the 1969 flood, but no official data are available.

TABLE 3- DISTRIBUTION OF LAND USE[1]

(Percent of forties[2])

Land Use	Counties		
	Marshall	Polk	Pennington
Cultivated	65.2	86.6	81.5
Pasture & Open	16.3	5.1	9.2
Forested	11.5	5.1	6.6
Water	1.4	1.3	0
Marsh	5.2	0.6	1.7
Residential	0.1	0.4	0.4
Non-residential or Mixed residential	0.2	0.7	0.4
Extractive	--[3]	0.1	0.1
Transportation	--[3]	0.1	0.1

[1] Minn. St. Planning Agency, Land Management Information in Northwest Minnesota, Report 1, 1972.

[2] A forty is 1/16th of a section, or 40 acres. It is the smallest unit of general land survey.

[3] Less than .1 percent

TABLE 4 - LANDSCAPE CHANGES[1]

County	Pre-Settlement Landscape (number of forties)			Present Landscape (number of forties)			Percent Change (number of forties)		
	Marsh	Forest	Grassland	Marsh	Forest	Grassland	Marsh	Forest	Grassland
Marshall	6,307	9,730	12,614	1,494	3,328	4,468	-76%	-66%	-62%
Polk	4,932	9,190	17,921	182	1,627	1,603	-96%	-82%	-91%
Pennington	1,960	4,064	3,829	157	639	941	-92%	-84%	-75%
Total	13,199	22,984	34,364	1,833	5,594	7,012			

[1]Minnesota State Planning Agency, Land Management Information in Northwest Minnesota, Report 1, 1972.

2.35 During the record spring flood of 1969, about 75 percent of Warren was flooded to shallow depths. A record peak discharge of 4,300 cfs (cubic feet per second), compared with the existing channel capacity of only about 1,400 cfs, occurred on 10 April 1969. In Warren, the flooding was first caused by storm sewer backup, then by the river overtopping the channel banks in the northeast area of the city. For about 3 days, the business district lacked water and sewer service, and most basements were flooded.

2.36 Records have been kept for a relatively short period of time at Warren. U.S. Geological Survey discharge records for the Snake River at Warren cover only March to September 1945 and October 1953 to September 1956. Table 5 presents flood data.

TABLE 5

FLOOD CREST ELEVATIONS, SNAKE RIVER AT WARREN, MINNESOTA, MINNESOTA STREET BRIDGE

Date of crest	Estimated peak discharge (cfs)[1]	Stage[2]	Elevation[3]
4-6 May 1950	3,510	18.4	853.4
April 1965	3,250	17.9	852.9
3 April 1966	3,410	18.4	853.4
10 April 1969	4,300	19.4	854.4
Intermediate regional flood	5,500		854.6
Standard project flood	10,500		857.1

[1] From elevation-discharge rating curve for old U.S. Geological Survey gage.

[2] From high water marks.

[3] Feet, mean sea level, 1929 adj. Elevations are based on a gage height of 835.0 feet.

2.37 Because of the short period of miscellaneous discharge records for the Snake River at Warren and Alvarado, longer records from a nearby basin (the Middle River) were analyzed and compared. Studies of peak discharges and frequency curves in this area indicate that the long period of record for the adjacent Middle River at Argyle (drainage area = 248 square miles) correlates well with the Snake River at Warren (drainage area = 175 square miles). Studies of peak flows at Argyle and at Warren indicate that the peaks vary with the 0.65 power of the drainage area ratio. The Argyle frequency curve was transferred to the Snake River at Warren and Alvarado.

2.38 Discharge-frequency curves for the Middle River at Argyle were derived from a study of the 29 years of record (1945 and 1950-1977). Of the 29 years of record, five peak flows were much lower than the others and were considered as low outliers. The ten lowest peak flows are shown in Table 6.

TABLE 6 - MIDDLE RIVER AT ARGYLE, MINNESOTA
LOWEST PEAK FLOWS OF RECORD

Rank	Water Year	Flow (cfs)
20	1972	729
21	1976	631
22	1952	612
23	1959	570
24	1955	527
25	1961	135
26	1954	128
27	1953	112
28	1973	93
29	1977	80

2.39 Several different discharge-frequency curves were developed using guidelines and procedures outlined in Water Resources Council (WRC) Bulletin No. 17A. Low flows were omitted and resultant frequency curves were plotted.

2.40 The largest flood of record for the Middle River at Argyle on 3 July 1975 was not the largest observed flood peak at Warren for two reasons:

a. The 1 and 2 July 1975 storm centered on the headwaters of the Middle River basin and only covered a small portion of the Snake River headwaters.

b. An internal overflow on the Snake River headwaters caused a large portion of this flood to bypass Warren. Because the overflow area has now been diked, this overflow will not be repeated during future floods.

2.41 The discharge-frequency curves for the Snake River at Alvarado (drainage area = 220 square miles) are also based on the records for the Middle River at Argyle. The Argyle frequency curves were transferred to the Snake River at Alvarado using a factor of 0.92, the 0.65 power of the drainage area ratio. The Alvarado discharge-frequency curves were plotted using "expected probability P_N"and Weibull's plotting positions. These frequency curves were developed to be used in design studies and should not be used for flood insurance studies.

2.42 Table 7 shows a comparison of the 100-year (Corps of Engineers) design discharge data and the 100-year intermediate regional or regulatory flood peaks used for flood insurance studies:

TABLE 7 - 100-YEAR FLOOD DATA

Site	Drainage Area (Square Miles)	100-Year (1%) Frequency Flood Peaks For Design Studies	For Flood Ins. Studies
Middle River at Argyle	248	6,800 cfs	5,940 cfs
Snake River at Alvarado	220	6,310 cfs	5,460 cfs
Snake River at Warren	175	5,490 cfs	4,750 cfs

2.43 A coincidental frequency analysis for the Snake River at Alvarado and the Red River of the North has not been developed for this study. This data was not computed because no records are available to develop the coincidental frequency analysis. In addition, there is a serious question as to the independence of events on the Snake River and Red River. The profile data for the Red River of the North at Oslo, Minnesota (6 miles west of Alvarado), indicate that flows like the 100-year (1-percent frequency) peak and greater on the Red River of the North main stem would definitely cause flooding at Alvarado. Therefore, it can be assumed that the 500-year peak stage, as determined for this study, would occur more often and that the 500-year (0.2-percent frequency) profile would be somewhat higher than that computed for no backwater from the Red River. This same coincidental backwater condition could also affect the other profiles to some extent.

Existing Water Management Projects

2.44 In October 1966, after suffering a severe spring flood, local interests began to construct a ring levee around Alvarado to prevent the annual flooding. Although this levee was nearly overtopped by the record-breaking 1969 flood, local citizens succeeded in emergency efforts to raise and reinforce the levee, preventing substantial flood damage to the community.

2.45 Following the 1969 flood, funds from the State of Minnesota and the U.S. Office of Emergency Preparedness were used to finance a project to snag and partially clear about 23 miles of the Snake River from its confluence with the Red River of the North to about 10 miles downstream from Alvarado. The 16 miles of river channel between Alvarado and Warren include about 3 miles of ditch constructed in 1896 as State Ditch No. 5.

2.46 Existing flood damage reduction works at Warren are largely the result of flood emergency preparations undertaken in the spring of 1971 with assistance by the Corps of Engineers. The emergency work included snagging and partial clearing of the riverbanks for about a mile downstream from Warren and some minor channel enlargement at a meander within the city limits.

2.47 Farm levees have also been constructed in some areas to protect individual fields or developments. These are earthen embankments near the river or parallel to ditches that drain the area.

Recreation

2.48 The recreational resources in this area relate primarily to hunting and nature interpretation. Boating, swimming, and camping facilities are scarce due to competition from recreation areas in Minnesota Planning Regions 2 and 4 and to a lack of sizeable lakes.[1] Development of lake-associated facilities in Region 1 is not expected to attract visitors from outside the region.

2.49 No major recreation development is currently proposed for Planning Region 1. The 1974 SCORP lists boating, swimming, and camping facilities as scarce commodities in this area. Development is recommended at the State level.

[1] 1974 Minnesota State Comprehensive Outdoor Recreation Plan (SCORP).

Social Setting

2.50 Social impacts resulting from clearing, snagging, and shelterbelt operations would be concentrated between river mile 34 and river mile 50. This stretch of the river is surrounded by agricultural lands, owned and operated by a total of approximately 55 people. Because this project would have little effect on larger, less frequent floods than those that occur once every 3 years, the social consequences of floods in Alvarado and Warren would not be significantly changed from the present conditions. (Alvarado is presently protected against a 10- to 20-year flood, and Warren against a 10-year flood.) The area of impact is predominantely rural and its social setting is most accurately described by statistics of rural Marshall County.

Population

2.51 From 1960 to 1970, Marshall County and the State of Minnesota as a whole experienced steady changes and shifts in population (see Table 8). Accompanying an 11.5 percent increase in State population has been a shift in population from rural to urban areas. Marshall County, although experiencing a similar shift in population, decreased in overall population by 8.4 percent from 1960 to 1970. This reduction may be explained in part by the lack of large urban areas within the county to attract and retain the emigrating rural population. In 1970, one-third of Minnesota's population was rural while the population of Marshall County remained 100-percent rural.

TABLE 8 - POPULATION BY URBAN AND RURAL AREAS (1960, 1970)

	State		Marshall	
	1960	1970	1960	1970
Total population	3,413,864	3,804,971	14,262	13,060
Urban	2,122,566	2,526,560	0	0
Percent of total pop.	62.2	66.4	0	0
Rural	1,291,298	1,278,411	14,262	13,060
Percent of total pop.	37.8	33.6	100	100

Source: U.S. Bureau of the Census; Census of Population; 1960 and 1970, General Social and Economic Characteristics.

Employment

2.52 Employment trends for Marshall County are similar to those found throughout rural Minnesota. Over the past two decades (1950 to 1970), the labor force in Marshall County has steadily declined in number while shifting concentration from agricultural employment to services, wholesale and retail trade, and manufacturing. The decline is due primarily to shifts toward more capital-intensive farming practices which require greater capital investments and fewer farm laborers. Substantial decreases in agricultural employment, however, have only partially been offset by increases in other areas of employment.

2.53 The employment figures in Table 9 clearly reflect the importance of agriculture in Marshall County. In addition to agriculture which employs 30.5 percent of the net labor force, many other employers (in both trade and services) are closely tied to agricultural production. For example, the implement dealer provides for the rural population and is highly dependent on the farmer in the county, despite the trend toward non-agricultural employment.

TABLE 9
EMPLOYMENT BY INDUSTRY, MARSHALL COUNTY, MINNESOTA
1970 TOTALS AND 1950 TO 1970 PERCENT CHANGE

	1970		1950-1970
	No.	% of total	% change
Agriculture	1,197	30.51	-67.7
Mining	0	0	-100.0*
Construction	251	6.40	6.8
Manufacturing	418	10.65	344.7
Transportation, communications, & utilities	185	4.72	-24.2
Wholesale and retail trade	753	19.19	.9
Finance, insurance & real estate	62	1.53	14.8
Services	899	22.92	60.8
Government (Public Administration)	158	4.02	32.8
Armed Forces	0	0	-
Industry not reported	0	0	-

Source: U.S. Bureau of the Census, Census of Population: 1950 and 1970, General Social and Economic Characteristics.

*1950 Mining employed 2 persons.

Agriculture

2.54 Census data for Marshall County and the State of Minnesota from 1969 to 1974 indicate slight changes in the land area contained in farms while the proportion of farmland used for crops remained relatively constant. In these 5 years, although Minnesota as a whole showed a decrease in the amount of farmland, Marshall County showed a slight increase (Table 10). Land-use patterns (cropland/woodland/other) within Marshall County farmland remained similar, with approximately 84 percent of all farmland being used for some sort of cropland in 1974. Part owners (those who operate land they own as well as land that they rent from others), although also decreasing in number, on the average now comprise a larger proportion of farm operators in 1974 than in previous years.

TABLE 10- FARMLAND AND USAGE PATTERNS, 1969 AND 1974

	Minnesota		Marshall	
	1969	1974	1969	1974
Approximate total land area (acres)	50,744,768	50,744,768	1,145,152	1,145,152
Percent of total land in farms	56.7%	54.4%	71.7%	74.6%
Total number of all farms	110,747	98,537	1,732	1,652
Land in farms (acres)	28,785,240	27,605,228	821,030	853,809
Cropland (acres)	22,260,500	21,320,870	668,059	703,900
Percent of farm acreage in cropland	77.3%	77.2%	81.4%	84.2%
Woodland (acres)	2,844,213	2,454,218	79,396	71,138
Percent of farm acreage in woodland	9.9%	8.9%	9.7%	8.5%
Other (acres)	3,680,527	3,830,140	75,575	78,771
Percent of farm acreage in other uses	12.8%	13.9%	9.0%	9.4%
Average size of farm (acres)	260	280	474	517

Percents may not total 100 due to rounding.

Source: U.S. Bureau of the Census, 1974, Census of Agriculture, Minnesota, May 1977.

2.55 In conjunction with State trends, the values of land and buildings per farm in Marshall County approximately doubled from 1969 to 1974. In the same span, the market values and production expense per farm in Marshall County were greater than State figures (Table 11). The market value of agricultural products sold per farm in Minnesota and Marshall County increased from 1969 to 1974 primarily as a result of two factors: (1) the increase in average farm size and (2) the increase in crop prices. However, other factors include improved management, increases in cropland, and improved technology. Unlike the State, the market value in Marshall County (1974) is heavily dependent on crops: over 90 percent of the market value came from crop products sold. Livestock, poultry, and their products yielded the remaining portion of market value for the county.

TABLE 11 - LAND VALUES, MARKET VALUE OF PRODUCTS SOLD AND PRODUCTION EXPENSES FOR MINNESOTA AND FOR MARSHALL COUNTY, 1969 AND 1974

	State		Marshall	
	1974	Percent change 1969-1974	1974	Percent cha 1969-197
Value of lands and buildings ($1,000)	11,855,130	82.3	183,917	104.1
Average per farm (dollars)	120,311	104.9	111,330	114.0
Market value of dairy products sold ($1,000)	3,469,923	98.5	63,907	194.2
Average per farm (dollars)	35,214	123.1	38,685	209.5
Crops (including hay)[1] ($1,000)	1,759,340	215.0	58,462	244.3
Percent of total market value	50.7		91.5	
Livestock, poultry, and their products ($1,000)	1,710,584	44.0	5,446	15.0
Percent of total market value	49.2		8.5	
Total farm production expenses ($1,000)	2,365,111	72.8	36,191	104.9
Average per farm (dollars)	24,048	94.6	21,907	114.8
Est. cost ratio	1.5		1.8	

[1]Nursery and greenhouse, and forest products, which account for less than 1% of the mark value for agriculture products sold, have also been included in this figure.

Source: U.S. Bureau of the Census, 1974, Census of Agriculture, Minnesota, May 1977.

Income

2.56 The predominantly rural county of Marshall had a per capita income ($1,9 well below the State per capita income of $3,052 in 1970. Rural non-farm and rural farm per capita incomes for Marshall County were also well below rural non-farm and rural farm per capita incomes for the State (as shown in Table 12 and the Marshall County percentage of families with earnings below poverty lev was higher than that of the State.

TABLE 12 - PER CAPITA INCOME AND INCOME LESS THAN POVERTY LEVEL, MINNESOTA, MARSHALL COUNTY 1970

	State	Marshall
Per Capita Income	$3,052	$1,971
Rural non-farm	$2,491	$2,278
Rural farm	$2,117	$1,612
Income Less Than Poverty Level		
Families	75,923	900
Percent of all families	8.2	27.8

Source: U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Tables: 124, 135, 137.

Cultural Resources

2.57 Between 21 August and 15 September 1975, a cultural resources survey was undertaken along 81.67 kilometers of the Snake River in Marshall and Polk Counties, Minnesota. (See Exhibits 1 and 2.) The purpose of the survey was to inventory and assess the impact of the proposed snagging and clearing project upon archaeological and historical resources. During the survey, information on 30 previously unknown sites was recorded. In addition to these, two sites identified during the literature search and records review were field checked. One site (21 MA 8) dating to the Late Woodland Blackduck Phase was partially excavated in 1960 by Eldon Johnson of the University of Minnesota.

2.58 Three classes of sites were recorded during the survey (Lane 1975):

a. Bone concentration: Areas in which a large amount of animal bone was found without associated artifacts or features.

b. Activity areas: Areas for which evidence of past human activity exists, but without sufficient artifactual remains or associated features to indicate long-term occupation.

c. Occupation sites: Areas of fairly well defined artifactual and contextual remains, indicating somewhat long-term human occupation.

2.59 The most numerous class of site found was the activity area, with 21 reported along the Snake River. Two bone concentrations were located, one probably the result of natural deposition. Nine occupation sites were also located during the survey.

2.60 A total of 19 sites (59.3 percent) were assigned to a cultural period. All but one of these, a historic site, contained some materials which were woodland in nature. Only one site (No. 72) was able to be placed in an earlier context than Woodland. This activity area was dated to the Late Archaic/Early Woodland Period, based on projectile point typology. Of the 18 sites identified within a Woodland context, 12 were unable to be placed within a Woodland subperiod; one was Early Woodland, two were Middle Woodland, and three were Late Woodland. Two of the three Late Woodland sites could be assigned to the Blackduck Phase.

2.61 The late nature of the sites located along the Snake River is not surprising since this area was once a portion of Glacial Lake Agassiz. During the terminal glacial period (6000-3000 B.C.), Lake Agassiz was still a glacial lake, although somewhat reduced in size from its former levels during the Port Huron (11000-10000 B.C.) and Valders (9000-8500 B.C.) glacial advances. Not until sometime after 3000 B.C. would this area have been available for continual occupation. Evidence recovered during the survey substantiates this fact. Occupation of the Snake River begins during the Late Archaic Period (ca. 3000 B.C.) and continues up until the present. Lane reports that settlement patterns during the past 5000 years have remained fairly constant. Larger, long-term settlements are found on the higher river terraces, while short-term seasonal sites and activity areas are located on both the higher and lower terraces.

3.00 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

3.01 Marshall, Polk, and Pennington Counties have not adopted any State-approved floodplain regulation program, but the counties do administer their own interim programs relative to issuance of building permits and shoreline regulations. These counties are also covered by National Flood Insurance programs. Marshall County is in the process of formulating floodplain regulations. Marshall and Polk Counties were requested by the State to formulate regulations for the area of the 100-year floodplain of the Red River of the North, which involves portions of the Snake River drainage system. Floodplain regulation ordinances would be consistent with the proposed snagging and clearing project. Agriculture generally is considered a compatible floodplain use.

3.02 Polk County has adopted a comprehensive development plan under which future use of this portion of the Snake River will be oriented toward agriculture.

3.03 The Middle River-Snake River Watershed District also has applied to the Soil Conservation Service (SCS) for assistance under Public Law 83-566. However, it would be a few years before SCS could investigate the application, which was approved by the State board in December 1971 and placed in the priority pool for planning in August 1976.

4.00 IMPACTS OF THE PROPOSED PROJECT

4.01 The proposed Snake River plan would have both adverse and beneficial impacts on fish and wildlife habitat and floodplain vegetation. The severity of the adverse impacts would vary with the amount of clearing and snagging done. The clearing and snagging would cause a significant loss of fish and wildlife habitat, and predator-prey relationships. Beneficial impacts of the shelterbelt construction would be channel protection and wildlife habitat development.

Flora

4.02 The proposed plan would remove some selected areas of shrubs and live trees and all non-rooted fallen trees and snags within the primary river channel. Specific types of vegetation exist in a floodplain because they can withstand periodic flooding. A reduction in the amount of flooding could affect the productivity of the woodland and cause a change in species composition, a reduced growth rate, or a combination of the two.[1]

4.03 Long-term effects of less frequent flooding on species composition and productivity would depend on the degree of flood reduction. In the case of the Snake River project, decreased productivity and altered species composition would be insignificant because the snagging and clearing would have minimal effect upon the less frequent flooding conditions. Regrowth, if snagging and clearing is not maintained, would cause the minimal flood reduction benefits to vanish.

4.04 The removal of the streambank vegetation would adversely affect the cycling of nutrients and organic matter. Leaves and insects from trees and shrubs fall into the river, adding nutrients and organic matter to the stream. This in turn is used by aquatic organisms and contributes to the overall energy flow of the stream.

4.05 Construction activities associated with the proposed plan would also have adverse impacts upon the vegetation. The winding nature of the river channel, particularly between Warren and Alvarado, would present a problem in confining the movement of construction equipment within the channel. The nature of the channel and the possibility of limited ice cover may require some on-bank movement of machinery. Access routes to the river channel might also have to be cleared because of the limited number of natural access points for areas requiring work. These activities would have a destructive effect on the river vegetation.

1

Hibbard, E.A. 1972. Vertebrate Ecology and Zoogeography of the Missouri River Valley in North Dakota. Ph.D. Thesis. North Dakota State University, Fargo, North Dakota. 216 pp.

Johnson, W.D. 1971. The Forest Overstory Vegetation of the Missouri River Floodplain in North Dakota. Ph.D. Thesis, North Dakota State University, Fargo, North Dakota. 151 pp.

Burgess, R.L., W.C. Johnson, and W.R. Keammerer. 1973. Vegetation of the Missouri River Floodplain in North Dakota. North Dakota State University, Fargo, North Dakota. WI-221-018-73.

4.06 Construction activities would be obstructed during winter because the channel area is frequently drifted in with snow, ranging in depth from 3 to 6 feet above the frozen surface. Snow removal in these areas would damage or destroy vegetation that the project would not normally have affected. These impacts could be reduced or eliminated by scheduling construction activities for early winter when the ground is frozen and there is little or no snow cover to interfere with construction.

Fauna

4.07 Fish - The clearing and snagging of the Snake River would affect the fish resources by the removal of essential habitat. In addition to the direct impact on the Snake River fishery, there would be a secondary impact on the Red River fishery. Tributaries of the Red River of the North produce a higher proportion of the forage fish species than does the main stem of the Red River of the North. Water quality of the tributaries is more conducive to forage species production than is the Red River itself. Therefore, removal of forage fish habitat in the Snake River would adversely affect the game fish species of the Red River.

4.08 The impact of the project upon aquatic life would result from the removal of scattered debris from the river and of shrubs and trees from the bank. The debris provides cover for fish and habitat for the aquatic organisms which are major fish food items. Removal of scattered debris usually reduces fish populations. The project would be conducted in the winter (at low water levels approaching the "dry" condition), but could conceivably remove significant amounts of seasonally submerged debris. If the river is partially dry or the water level is very low at the time of the project, large amounts of otherwise submerged debris would be removed. The more debris removed, the greater the effect on the fishery. Removal of trees that would have fallen into the river would also decrease the future fishery values by removing potential aquatic habitat for fish and forage species.

4.09 Removal of debris from the primary channel would eliminate habitat for attached or free-swimming invertebrates for part or all of their life cycle. Eliminating debris would also adversely affect fish population dynamics. Debris cover provides spawning areas for game and forage species such as walleye, pike, and flathead minnows. Submerged debris provides cover for and protects lower age and size classes from predation. The debris also provides invertebrate food sources for both game and forage species.

4.10 Reduction in the amount of vegetation along the edge of the river could have adverse effects on the benthic community as well as the fishery. The impacts result from a reduction in the amount of leaves and other organic debris that is generated from the edge vegetation. There is a reduction in the amount of invertebrates that live in association with the edge vegetation and end up as a food source for river organisms. Both

of these provide an input to the energy flow conditions of the river. Changes in bottom stability could cause a change or a loss in the benthic community. These effects are not expected to be significant overall.

4.11 Wildlife - Clearing and snagging would remove some existing and potential nesting and resting sites for wildlife. Some species of birds, such as nuthatch (Sitta sp.), chickadee (Parus sp.), bluebird (Sialia sialia), wood duck, woodpecker (Picidae sp.), and barred owl (Strix varia), nest in the cavities of trees. Removal of debris and trees would have an adverse effect on these birds. Resting, nesting, and feeding areas for species such as herons (Ardeidae sp.), bitterns (Ardeida sp.), kingfishers (Megaceryle alcyon alcyon), wood ducks, and hooded mergansers (Lophodytes cucullatus) would also be affected by clearing and snagging the river.

4.12 The project would remove some brush from the river channel. Dense stands would be cut if their removal is hydraulically desirable and would not aggravate erosion. The removal of shrubs would have adverse impacts on deer and other riverbank animals such as birds and beaver. The cutting of shrubs would remove cover, nesting habitat, and food for the wildlife. Shrubs, especially along river channels, are important habitat for non-game bird life. A large proportion of the cover and nesting sites for small birds is provided by shrubs and in trees less than 30 feet above the ground.

4.13 The bank area is important to many species of wildlife that are dependent on the water-vegetation edge for all or part of their life cycle. For example, beaver and mink forage in this area and use it for cover. Birds, both game and non-game, use this area for cover, nesting, and food. The removal of streambank vegetation would adversely affect these species. Clearing the streambank would also open the area to predation.

4.14 It is impossible to predict exactly what impact the clearing and snagging of the Snake River would have on fish and wildlife resources. Removal of significant amounts of debris can be expected to result in decreased wildlife populations. The more extensive the clearing (removing more debris or more extensive clearing activity), the more adverse the effects.

4.15 Shelterbelt construction would prove to be very beneficial for wildlife. It would provide a movement corridor through areas that have had their wooded cover eliminated or reduced to where it provides little benefit for wildlife. The planting scheme, involving a combination of tree and shrub heights and a variety of species which have food value

for wildlife, would create a zone of valuable habitat. This area would provide food and cover during winter and should help to alleviate some of the pre-reproductive season stresses. Increasing the diversity and amount of riparian habitat would involve development of many complex ecosystem relationships, including community diversity, protection from predation, winter shelter, forage and prey resources, winter food, nesting sites, and denning sites, as well as corridors of movement for transient as well as for local wildlife.

Endangered or Threatened Species

4.16 As noted in paragraphs 2.23-2.24, the grey wolf is the only endangered or threatened species known to occasionally frequent the project area. The removal of some edge vegetation would reduce the amount of cover and huntable habitat available to wolves that wander into the project area, but this impact would be offset by the planting of shelterbelts in selected areas. There should be an overall insignificant impact on the grey wolf as a species and a population. (See letter of 5 September 1979 from the Fish and Wildlife Service, included as Exhibit 3.)

Flooding

4.17 Snake River channel capacities for existing conditions are computed to be 1400 cfs (3-year frequency) from the mouth to River Mile 21.2, 700 cfs (2-year frequency) from River Mile 21.2 to Warren, and 600 cfs upstream of Warren. The clearing of the lower two-thirds of the riverbank could result in a channel capacity of 900 cfs (3-year frequency) from River Mile 21.2 to Warren.

4.18 Benefits from shelterbelts would vary from year to year, due to changes in snowmelt rate and amount of snowfall. Shelterbelts would prevent snow accumulation from blocking the channel in spring, and thus help drain snowmelt waters from adjacent agricultural areas. This would reduce the spring overland flooding problems, damages to farm property and buildings, and the amount of nitrogen leached from the soil. These benefits would change with the severity of the winters, in terms of the amount of snow and the rate of melting.

4.19 Clearing and snagging would have little effect on a flood of more than a 3-year frequency (i.e., 33-percent chance flood), which would exceed the present channel capacity. It would reduce damages caused by the 3- to 5-year (33- to 20-percent chance) floods, have progressively less effect on floods over a 5-year frequency, and have no effect on fairly infrequent floods.

4.20 Project-related effects on Red River main stem flooding would be minimal. Under optimal conditions the project would have localized beneficial effects due to a slightly higher channel velocity, thus a shortened flood duration and earlier peak. The effect would then be a flood peak slightly earlier than that of the Red River.

Land Use

4.21 The project is not expected to have adverse impacts on geological features. The recreational and aesthetic qualities would receive overall positive impacts, although clearing and snagging would have some negative impacts. This stretch of river at present supports little developed

recreational opportunity. The habitat created by the shelterbelts would create possibilities for development of recreational resources. An increase in trapping and hunting opportunities would be closely associated with an increase in the amount of habitat. Hunting and fishing activities would add to the economy of surrounding towns. Snowmobile activity in the area could increase with clearing of the channel. There would be an adverse impact on wildlife, however, associated with increased snowmobile activity. The value of the area for non-consumptive uses such as photography, hiking, and skiing would increase.

4.22 Agricultural impacts would generally be positive. Better melt water drainage would provide earlier access to the fields. There would be less leaching of nitrogen from the soil as a result of spring overland flows. There would be less agricultural damage because of heavy summer rains and associated flooding. The loss of some agricultural land to shelterbelt construction would have some adverse impacts. These lands could be of marginal value because their close proximity to the river makes crops very susceptible to high frequency floods.

4.23 The area on the leeward side of the shelterbelt could be adversely affected by possible snow build-ups where snow would melt more slowly than on the surrounding lands. Consequently, these areas would not be ready for planting at the same time as other farm lands in the area. The extent of this problem would vary with the amount of snowfall and the degree of drifting.

Air and Water Quality

4.24 Some degradation of air and water quality could be caused by construction equipment. Water pollution could result from oil, grease, or fuel spilled onto the ice or leaking from machinery. Airborne dust would not be much of a problem because the project work would be done during winter when the river is frozen. The project could have an impact on some water quality properties such as temperature, dissolved oxygen, and turbidity. The extent of these changes is not known. The effect of the vegetation removal on water quality parameters varies with the extent and methods of clearing and the characteristics of the stream. Selective clearing and snagging would probably result in some degree of increased turbidity, increased water temperature, and reduced oxygen levels.

4.25 Shelterbelts would reduce the amount of windblown soil (which contributes to turbidity and channel siltation) and pesticide drift and runoff into the channel.

4.26 Seasonal loadings of nutrients and suspended solids on the Red River due to increased channel efficiency would be minor or insignificant. The reason is that the degree and duration of increased efficiency would be relatively low and that at the time of high flows the diluting capabilities of the Red River would be quite high.

Hydraulic Aspects

4.27 Extent of Clearing and Snagging - Because of the complexity of the processes occurring in natural flows involving the natural equilibrium of a stream, the analysis of the effects of clearing and snagging is generally limited to consideration of only the hydraulic relationships, assuming changes only in channel roughness. This approach shows that only limited clearing of the channel is needed to obtain most of the stage reduction benefits that can reasonably be expected from a clearing and snagging project.

4.28 In its most efficient form, a clearing and snagging project includes not only the complete clearing of debris and snags in the stream channel but also complete removal of all trees, fallen branches, and brush from the primary banks of the channel and the overbanks. The experience of the Corps of Engineers with projects of this type has led to the conclusion that, if complete clearing of the channel and at least 20 feet of the immediate overbanks is not accomplished in the initial phase, the effectiveness of the project for controlling the more frequent floods decreases rather rapidly with time. Subsequent maintenance of the project becomes more expensive and is required more frequently to keep the project effective. From a maintenance efficiency standpoint, the proposed Snake River project would use the least efficient clearing procedure.

4.29 General Effect of Clearing and Snagging - All actively meandering streams will show evidence of erosion and deposition. The Snake is typical, with deposition occurring on the inside and erosion on the outside of bends. Clearing and snagging will increase the speed by which the meander loops move downstream. Also, by increasing the amount of flow which remains in the channel, the meander length will change, probably by increasing. This change in stability can lead to increased erosion and possibly some channel shifts during unusually high flows. If trees and brush are not removed from the channel and immediate overbanks, more debris will fall into the river as it adjusts to its new equilibrium form. All flows that approach the new channel capacity in magnitude will cause some bank failure. With the limited clearing that is proposed on the Snake River, even minor bank sloughing could cause big trees and brush to fall into the river. After a few years, the river could be back to its pre-project condition unless continued maintenance is undertaken.

Recreation

4.30 Clearing, snagging, and shelterbelt development could have a beneficial impact on existing resource potential. Most of this impact will be derived from the additional wildlife habitat created by the shelterbelts and the selective clearing process proposed for this project.

Social Impacts

4.31 The following paragraphs discuss only those areas of the socioeconomic environment where impacts are predicted. These areas include real income, employment/labor force, aesthetics, controversy, community cohesion, noise, and impacts of material disposal. Other areas of effect specified in section 122 of Public Law 91-611 have been analyzed and no impacts are predicted.

4.32 Real Income - This project, designed to protect only against a 3-year flood, is expected to provide financial benefit to landowners (between Warren and Alvarado) by reducing crop, soil, fence, and some building damages, and by allowing farmers early access to fields. In addition, some secondary benefits would accrue to local agricultural services and businesses as a result of increased revenues to local farmers. These benefits would offset the economic loss to farmers of taking cropland out of production for placement of 45-foot-wide shelterbelts.

4.33 To minimize cropland loss and maximize agricultural use, shelterbelts can be planted anywhere from 150 to 500 feet from the top of the channel. This would allow lands between the shelterbelt and the top of the channel to be farmed. Benefits from the shelterbelt would differ yearly due to variations in the amount of snowfall and rate of snowmelt.

4.34 Employment - Since clearing, snagging, and shelterbelt planting require few workers, the project would only slightly benefit local employment. Labor to be used in project construction would be supplied by the local labor force and would probably have no effect on persons presently unemployed. The clearing and snagging operation would be contracted with a local construction firm while a local agricultural extension office would assume responsibility for planting the shelterbelt. The local sponsor would be accountable for project maintenance and would most likely also use workers from the local labor force. Once again, the number employed would be insignificant.

4.35 Aesthetics - To the greatest extent possible, existing roadways would be used for access routes to the river. Additional clearing and roadways would be used only where existing routes are inadequate. There would be temporary inconveniences such as aesthetic disruptions, increased traffic and associated noise, but these are not expected to be significant since disruptions would occur along stretches immediately adjacent to agricultural fields and areas already accustomed to farm machinery activities and noise levels.

4.36 Selective and minimal clearing and snagging would slightly impact area aesthetics. Debris removal and bank clearing may be viewed by some people as a visual improvement, while others may view it as an aesthetic violation. In either case, the impact would be minimal.

4.37 Shelterbelts, on the other hand, are likely to be perceived by most people as an enhancement to the aesthetic quality of the predominately agricultural setting, adding a variety of vegetation and providing wildlife habitat.

4.38 Controversy and Conflict - Local landowners have requested that shelterbelts be incorporated as part of the project to prevent blockage of the river channel by snow and ice deposits, which results in overland flooding. Landowners have testified that northwesterly winds are responsible for snow drifting into the channel. However, this has not been officially documented by the Corps. Because shelterbelts would be placed along only the north side of the channel, it is possible that snow may drift into the channel from the south side or downstream of the shelterbelted area, causing waters from the spring snowmelt to back up and overflow onto shelterbelted properties. If this occurred, landowners with shelterbelts may receive flooding more severe than the flooding they experience without shelterbelts. This condition is possible because more water would remain in the river channel and would travel at a greater velocity. Because landowners with shelterbelts expect benefits from them, controversy may arise.

4.39 The local sponsor is responsible for obtaining by fee-title or easement all lands necessary for access routes to the river, windbreaks, and debris disposal sites. If these requirements were not met, the entire project would be discontinued. Because of funding limitations an attempt would be made by the local sponsor to fulfill these requirements with minimum expense. Further, the local sponsor would purchase lands from willing sellers only. If local-sponsor responsibilities could not be fulfilled under these conditions (low cost and voluntary land acquisition), it is expected that the Watershed District would resign as the local sponsor and the project would be discontinued. As a result, the previously mentioned social benefits (from reduction of agricultural and other flood damages) would not occur. Because the local sponsor would purchase lands from willing sellers only, project implementation may be jeopardized by those unwilling to sell.

4.40 Verbal commitments have been made by landowners to allow shelterbelts at all required locations; however, these commitments were made with the assumption that easements were voluntary and not legally binding. Therefore, these commitments are subject to change and the potential for controversy exists between willing sellers and those not willing to sell. Obviously, those willing to sell perceive shelterbelts as part of the solution to their flooding problem. Without unanimous support from all landowners whose land is required for an effective shelterbelt (as determined by the Corps of Engineers), the project would be discontinued. Depending upon the importance of this project as perceived by area residents, controversy over this issue may negatively impact community cohesion.

Noise

4.41 During clearing and snagging operations and the planting of the shelterbelts, noise levels in the vicinity of Snake River would increase due to use of construction equipment. Persons living on farmsteads along the river would be affected. However, increased noise levels would be minimally significant since most of the clearing, snagging, and planting would occur along stretches of river immediately surrounded by agricultural fields.

Impacts of Material Disposal

4.42 Specific disposal site locations have not been identified at this time. However, alternative methods of disposal include stockpiling salvageable materials, while either hauling, burning, or burying unsalvageable materials. Salvageable materials would be stockpiled at temporary sites, preferably near the river, and would be made available for personal use by local residents. Since wood is a valuable resource, stockpiling would provide a direct benefit to local area residents.

4.43 Since disposal sites for burning, and burial and hauling destinations have not yet been determined, not all of the relevant social impacts can be predicted. Because designated disposal sites would most likely be landfill areas, social impacts are expected to be limited to minor inconveniences from additional traffic of hauling and its associated noise. To minimize costs, the local sponsor prefers to keep hauling distances at a minimum.

Cultural Resources

4.44 In compliance with Section 106 of the National Historic Preservation Act of 1966 and Executive Order 11593, the National Register of Historic Places has been consulted. As of 9 September 1980, no sites listed on or eligible for inclusion on the National Register would be affected by the Snake River clearing, snagging, and shelterbelt project.

4.45 A cultural resources survey was conducted of the proposed project area in 1975. This survey resulted in the location of thirty-two prehistoric and historic sites. Of these, fourteen were either extremely eroded or had only limited cultural materials. Of the other eighteen sites, nine were recommended for further testing and nine for mitigation. (See Exhibits 1 and 2.)

4.46 Since that time, however, the type and extent of expected impacts upon the sites have been reevaluated. Since the proposed snagging and clearing operations would not involve removing entire trees (rather only cutting them to six-inch height) and would be performed in winter (when the ground would be frozen), there would be no actual ground disturbance. Furthermore, snagging and clearing operations would avoid all archaeological sites, and site boundary marking would be undertaken to ensure avoidance. Thus, clearing and snagging along Snake River would not affect any known cultural resources.

4.47 Nor would the shelterbelts impact any known cultural resources. The entire project area was vegetated prior to clearing for agricultural use, and the present agricultural practices in the area include deep, chisel plowing. No further damage to possible cultural resources - that is, in addition to damage already done by clearing, cropping, and plowing - is expected from the planting of shelterbelts.

4.48 However, should any previously unrecorded cultural materials be located during any of the proposed construction activities, all work would cease until an assessment of significance can be made. Impacts on significant cultural resources would be dealt with in accordance with 36 CFR Part 800, Guidelines of the Advisory Council on Historic Preservation.

5.00 UNAVOIDABLE ADVERSE IMPACTS OF THE PROPOSED ACTION

5.01 Unavoidable adverse impacts involve the loss of a large amount of live and dead vegetation and aquatic habitat over a 50-mile reach of the Snake River. Clearing and snagging would have significant adverse impact on the fish resources of the Snake River and a secondary adverse impact on the fish at high levels in the food web (some game fish) in the Red River. Removal of riparian habitat would also adversely affect furbearers, snapping turtles, and avian fauna along the Snake River. Streamside vegetation and debris are invaluable ingredients in the life cycle of a number of wildlife species.

5.02 The increase in channel flow velocities which would result from the project would increase erosion and sedimentation in the project area. An increase in erosion would affect some water quality parameters such as turbidity. Sedimentation, shifting substrate, and siltation would also have an adverse effect on benthic organisms.

6.00 ALTERNATIVE PLANS CONSIDERED

No Action - Maintain Status Quo

6.01 Maintaining the status quo (recommending that no action be taken to alleviate flooding and related problems) would not burden local interests and the Federal Government with the costs associated with other alternatives. Nevertheless, average annual damages estimated at $495,000 would remain as a severe social and economic burden. Floodplain farmers would continue to sustain substantial loss of income due to periodic inundation of about 20,000 acres of cropland; soil erosion; and damage to houses, barns, stored crops, machinery, and other farm property. No changes in land use would be anticipated since the floodplain area under study is highly productive, almost totally cultivated agricultural land. Accordingly, the social well-being and environmental quality of the area would not be affected.

Nonstructural Alternatives

6.02 Because flooding is the major water-related problem under study and because nonstructural measures can often be employed effectively to reduce flood damages, such measures were considered for flood-prone areas along the Snake River below Warren. Nonstructural measures applicable to the flood-prone area include: flood warning and emergency protection, flood insurance, flood proofing, floodplain regulation, and permanent floodplain evacuation.

6.03 Alt. 1 - Flood Warning and Emergency Protection - An emergency protection plan depends on an effective flood warning system. Flood warning consists of predicting the timing and magnitude of floods to allow for timely evacuation of flood-prone areas or erection of emergency flood protection.

6.04 The National Weather Service currently provides area officials and local news media with flood forecasts and warnings for the Snake River at Warren and Alvarado. The spring snowmelt flood and major floods that result from excessive summer rainfall can be reasonably predicted by methods currently available. However, the time intervals between rainfall, issuance of a flood warning, and beginning of flooding are much shorter than for snowmelt floods. Emergency evacuation of people and their belongings or construction of emergency flood protection might be effective for spring snowmelt floods, but such measures would be much less effective in preventing damages from floods caused by excessive rainfall runoff.

6.05 Emergency protection measures in the Snake River basin have been limited to localized dike construction at Alvarado and at several

Impacts of alternative flood damage reduction plans for the Snake River basin below Warren, Minnesota

Item	No action	Plan 1 Flood warning and emergency protection(1)	Plan 2 Flood insurance(1)	Plan 3 Flood proofing(1)	Plan 4 Floodplain regulation(1)	Plan 5 Evacuation(1)	Plan 6 Levee and floodway	Plan 7 Channel modification	Plan 8 Diversion channel	Plan 9 Three upstream reservoirs	Plan 10 Snagging and clearing(2)
NATIONAL ECONOMIC DEVELOPMENT											
Total first cost ($ million)(3)	0		0	8.3	0.4	55.5	16.5	12.4	3.4	15.3	0.7
1. Federal first cost ($ million)	0		0	6.6	-	44.4	11.3	10.4	2.2	12.8	0.6
2. Non-Federal first cost (4 million)	0		0	1.7	-	11.1	5.2	2.0	1.2	2.5	0.1
Total annual operation, maintenance, and replacement cost (non-Federal) ($1,000)	0		424.0	73.0	35.0	0	36.0	21.0	21.0	40.0	15.0
Total average annual cost ($1,000) (4)	0		424.0	703.0	65.0	4,100.0	1,289.0	962.0	279.0	1,170.0	67.9
Total average annual benefits ($1,000)	0	11.0	0	50.0	33.0	95.0	258.0	258.0	61.0	114.0	162.8
Net average annual benefits ($1,000) (5)	0		0	-653.0	-32.0	-4,005.0	-1,031.0	-704.0	-218.0	-1,056.0	+94.9
Remaining average annual flood damages ($1,000)	495.0	484.0	495.0	445.0	462.0	400.0	237.0	237.0	434.0	381.0	332.2
Benefit-cost ratio	-	-	-	0.07	0.51	0.02	0.20	0.27	0.22	0.10	2.4

Impacts of alternative flood damage reduction plans for the Snake River basin below Warren, Minnesota

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ENVIRONMENTAL QUALITY(2)											
Woodland lost or gained (± acres)											
1. Upland	0	0	0	0	0	0	0	0	0	80	0
2. Lowland	0	0	0	0	0	0	-5	-450	-15	160	-122
3. Windbreak	0	0	0	0	0	0	-10	-10	0	-	15
Wetlands lost or gained (± acres)											
1. Meadow or marsh	0	0	0	0	0	0	0	0	0	+300	0
2. Conifer bog	0	0	0	0	0	0	0	0	0	0	0
Lake area lost or gained (± acres)											
1. Fish	0	0	0	0	0	0	0	0	0	0	0
2. Marginal	0	0	0	0	0	0	0	0	0	+460	0
Steams affected											
1. Existing unchannelized											
a. Linear miles of stream	0	0	0	0	0	0	-45	-45	0	-10	-45
b. Low-flow water surface area (± acres)	0	0	0	0	0	0	0	+200	0	+460	0
c. Secondary channel & bank area (± acres)(6)	0	0	0	0	0	0	+800	+800	+1	+2,990	0
2. Existing channelized											
a. Linear miles of stream	0	0	0	0	0	0	+3	+3	+7.6	0	0
b. Low-flow water surface area (± acres)	0	0	0	0	0	0	0	+23	+15.0	0	0
c. Secondary channel and bank area (± acres)(6)	0	0	0	0	0	0	+54	-	+125	0	0
Effect on wildlife management area and refuge	0	0	0	0	0	0	0	Adverse effect on 51 m. of river	0	+2,960	Adverse effect on 52 m. of river
Effect on river water quality	Same	Same	Same	Same	Same	Temp. reduc.	Temp. reduc.	Temp. reduc.	Temp. reduc.	Temp. reduc.	Temp. reduc.
Effect on air quality	None	None	None	None	None	None	None	None	None	None	None
Effect on local life forms											
1. Terrestrial	None	None	None	None	None	None	Loss of veg. & w.l. hab.	Loss of veg. & w.l. hab.	Loss of veg. & w.l.hab.	Loss & gain of veg. & w.l. hab.	Loss of veg. & w.l. hab.
2. Aquatic	None	None	None	None	None	None	Disruption of 50 mi. of channel bottom		None	Conversion to lake ecosystem	Removal of aquatic hab.
Unique threatened or endangered animal species affected	None	None	None	None	None	None	None	None	None	None	None
Rare or unique vegetation systems affected	None	None	None	None	None	None	None	None	None	None	None
Scenic, recreation or wilderness sites and aesthetic qualities affected	None	None	None	None	None	None	All alternatives would affect aesthetic qualities.				
Historical and/or archeological sites affected (specify)	----------Effects unknown----------						----------Not surveyed----------			Approx. 20 known sites in river corridor	
Effect on river erosion	None	None	None	None	None	None	None	None	None	None	None
Mineral resources affected	None	None	None	None	None	None	None	None	None	None	None

Impacts of alternative flood damage reduction plans for the Snake River basin below Warren, Minnesota (Cont)

Item	No action	Plan 1 Flood warning and emergency protection(1)	Plan 2 Flood insurance(1)	Plan 3 Flood proofing(1)	Plan 4 Floodplain regulation(1)	Plan 5 Evacuation(1)	Plan 6 Levee and floodway	Plan 7 Channel modification	Plan 8 Diversion channel	Plan 9 Three upstream reservoirs	Plan 10 Snagging and clearing(2)
SOCIAL WELL-BEING (7)											
Flood protection											
1. Residences protected	0	0	0	120		120	120	120	120	700	120
2. Businesses protected	0	0	0	13		13	13	13	13	96	13
3. Persons protected	0	0	0	900		900	900	900	500	3,100	900
4. Total flood damage reduction (percent)	0	1.0	0	17.0	23.0	20.0	46.0	46.0	53.0	30.0	17.3
5. Agricultural lands protected	0	0	0	0	0	0	20,000	20,000	10,000	20,000	20,000
a. Farmsteads protected			0	262	10	262	262	262	130	262	262
6. Effects on downstream flood protection	Same	Same	Same	Same	Same	Same	Slight Decrease	Slight Decrease	Slight Increase	Slight Increase	Slight Increase
Relocations required											
1. Farmsteads	0	0	0	0	0	262	30	5	0	1	0
2. Businesses	0	0	0	0	0	13	0	0	0	0	0
3. Residences	0	0	0	0	0	120	0	0	0	0	0
4. Persons	0	0	0	0	0	1,100	100	20	0	4	0
5. Highways and roads (miles)	0	0	0	0	0	0	0	0	0	2	0
6. Utilities (miles)(8)	0	0	0	0	0	6	0	0	0	2	0
Lands required (acres)											
1. Cropland	0	0	0	0	0	100	580	750	325	200	100
2. Pasture	0	0	0	0	0	100	0	0	0	250	50
3. Natural habitat	0	0	0	0	0	200	5	450	5	3,000	0
4. Park and open space	0	0	0	0	0	0	0	0	0	0	0
5. Other lands(9)	0	0	0	0	0	0	0	0	0	0	0
Bridge replacements	0	0	0	0	0	0	1	1	5	1	0
Roads severed	0	0	0	0	0	0	0	0	5	1	0
Socially important sites affected(10)	0	0	0	0	0	0	0	0	0	0	0
Effect on community patterns	None	None	None	None	Minor	Major	Minor	None	None	None	None
Improvement of public health and safety	None	None	None	Minor	Minor	Major	Moderate	Moderate	Moderate	Moderate	Moderate

Impacts of alternative flood damage reduction plans for the Snake River basin below Warren, Minnesota (Cont)

Item	No action	Plan 1 Flood warning and emergency protection(1)	Plan 2 Flood insurance(1)	Plan 3 Flood proofing(1)	Plan 4 Floodplain regulation(1)	Plan 5 Evacuation(1)	Plan 6 Levee and floodway	Plan 7 Channel modification	Plan 8 Diversion channel	Plan 9 Three upstream reservoirs	Plan 10 Snagging and clearing(2)
SOCIAL WELL-BEING (Cont)											
Increased potential for usable water supply	None	None	None	None	None	None	None	None	None	None	None
Recreation opportunities affected											
1. Hunting	None	None	None	None	None	Minor Increase	Minor Loss	Major Loss	Minor Increase	Increase	Minor Loss
2. Fishing	None	None	None	None	None	Minor Increase	Minor Loss	Major Loss	Minor Increase	Minor	Minor Loss
3. Trapping	None	None	None	None	None	Minor Increase	Minor Loss	Major Loss	Minor Increase	None	Minor Loss
4. Boating	None	None	None	None	None	None	None	None	None	None	None
5. Camping	None	None	None	None	None	None	None	None	None	None	None
6. Canoeing	None	None	None	None	None	None	None	None	None	Minor Increase	Minor Increase
Reduction in snow accumulation in channel	None	None	None	None	None	None	Yes	Yes	None	None	Yes
REGIONAL ECONOMIC DEVELOPMENT											
Loss in area tax base	None	None	None	None	None	None	Minor	Minor	Minor	Minor	None
Area redevelopment benefits	None	None	None	None	None	Yes	Yes	Yes	Yes	Yes	Yes
Increased recreation expenditures	No	No	No	No	No	No	No	No	No	Yes	No
Effect on regional economic growth	None	None	Slight Increase	Slight Decrease	Slight Decrease	Decrease	Increase	Increase	Increase	Increase	Increase

(1) Costs do not include the city of Warren.
(2) Plan includes clearing the lower two-thirds of the channel.
(3) Based on October 1980 price levels.
(4) Includes annual operation, maintenance and replacement costs plus interest and amortization charges based on a 7 3/8 percent interest rate.
(5) Total average annual benefits minus total average annual costs.
(6) Does not include lowlands, woods, and brush area.
(7) Flood protection refers to reduction of threat to safety and well-being of individuals due to floods; it does not imply complete flood protection from the intermediate regional flood and does not include protection to downstream areas.
(8) Includes water, sewer, electric and telephone lines but excludes private sanitary systems.
(9) Includes urban area, farmsteads, roads, highways, railroads, windbreaks, existing drainage ditches, etc.
(10) Includes cultural sites, cemeteries, developed parks, town halls, etc.

farms adjacent to the river to protect fields. Most of the emergency dikes in place were constructed and financed by local interests, do not meet standards for permanent levees, and therefore, require constant maintenance and repair during floods. Temporary evacuation of the protected area as a safety precaution also places a burden on the manpower and finances of those affected. The resources of local and other agencies are further strained to provide necessary and often specialized transportation, equipment, temporary lodging, and personal services.

6.06 Alternative 1 would have no significant beneficial impacts on the economic development, environmental quality, and social well-being of the study area. Flood warnings with subsequent emergency actions could alleviate about 2 percent of the total flood damages in the Snake River watershed. Over $484,000 average annual flood damages would remain. Because the costs for providing flood warnings and emergency protective actions are uncertain, the net benefits of this plan cannot be estimated, and it is not known whether such a plan would be beneficial. Accuracy of the flood warnings and adequacy of the emergency actions taken would play a large role in determining actual costs and benefits of such a plan. On a short-term basis and in the absence of any other means of flood damage reduction, flood warning and subsequent emergency actions may help to reduce flood damages in the urban areas. However, as a means of permanent flood damage reduction and as a long-term solution to flood problems for the Snake River area below Warren, Alternative 1 would not be effective.

6.07 Alt. 2 - Flood Insurance - Federally-subsidized flood insurance is available to area residents in the Snake River basin below Warren. The National Flood Insurance Program of the U.S. Department of Housing and Urban Development offers insurance coverage for farm homes, other farm buildings, and their contents, up to prescribed limitations. Unsubsidized crop insurance available under the U.S. Department of Agriculture Federal Crop Insurance Program now covers all natural disasters including floods. Only a small percentage of qualified property owners presently take full advantage of these programs, probably because of the high remaining costs involved. Based on current accrual rates and the Federal subsidized limitations, the total cost for complete flood insurance coverage would approximate $424,000 annually. Flood insurance does not solve flood problems and does not reduce the damages but merely spreads the monetary loss over a wider population sector. Thus, average annual damages of $495,000 would remain. Accordingly, flood insurance cannot be considered an acceptable long-term solution to the flood problem under study or a very suitable short-term solution because of limited participation due to high costs.

6.08 Alt. 3 - Flood Proofing - Flood proofing involves a combination of structural changes and adjustments to flood-prone properties for reduction of flood damages. Several days of flooding and appreciable flood depths would cause seepage through the walls of most structures, even with effective sealing of doorway and window openings. Even if farmstead and residential structures could be protected successfully by flood proofing measures, flood proofing would alleviate only 9 percent of the estimated total average annual flood damages. Average annual remaining damages would approximate $445,000. The sociological effects of flooding (such as disruption of transportation, isolation of residents from their homes and farming operations, well contamination, vector production, and interrupted access to flood-proofed structures during severe floods) would remain. This alternative would not beneficially affect agricultural land, reduce crop damage, or change land use. Accordingly, the social well-being and environmental quality of the study area would remain essentially unchanged.

6.09 Alt. 4 - Floodplain Regulation - Measures for modifying floodplain land use and development do not control or eliminate flooding but are designed to shape floodplain development to lessen the future effects of floods. Such measures require local governmental units to adopt and use legal tools to control the extent and type of future development permitted in the floodplain. This requires public understanding of the general flood problem, degree of risk, and various means of controlling land use. Floodplain regulation measures include zoning regulations, subdivision regulations, building codes, and bridge construction regulations. However, damages to crop production and existing developments rather than potential increased damages to future structures and facilities constitute the major flood problem under study. Thus, floodplain regulations would not significantly reduce flood damage because they could alleviate only about 5.6 percent of the total estimated annual damages. With floodplain regulations in effect, remaining average annual damages to crop production and existing development would approximate $462,000. No significant land-use changes would be anticipated because of the highly fertile and productive agricultural lands involved. Thus, floodplain regulation would have little impact on the social well-being of the people in the area and on environmental quality. Natural vegetation and wildlife would benefit only to the extent that developments were regulated.

6.10 Alt. 5 - Permanent Floodplain Evacuation - Permanent evacuation of the floodplain and conversion of land use involves removal and relocation of all improvements including farmsteads, other buildings, equipment, and stored crops from the floodplain; evacuation and resettlement of the rural population; and permanent conversion of such lands to land uses less susceptible to flood damage. Floodplain evacuation, although completely unacceptable to local interests, has been analyzed for the buildings

located within the 1969 flooded area (approximately 25-year or 4-percent frequency flood) which involves about 262 farmsteads and residences. Evacuation of the rural community to a flood-free area would require moving both the improvements mentioned above and the population an average of 12 miles east to the escarpment area. This alternative was found to be clearly economically infeasible, with average annual benefits and costs estimated at $95,000 and $4,100,000, respectively, yielding a benefit-cost ratio of only 0.02. Alternative 5 would alleviate only about 23 percent of the total flood damages while remaining average annual damage would approximate $400,000. In addition, massive social, institutional, and physical problems make this plan seem highly impractical. Rural community cohesion would be severely disrupted and long-standing sociological ties would be lost. Further, it is questionable whether the affected farming businesses could continue to function as a viable economic operation since the farm equipment and manpower would require mobilization and demobilization an average distance of 12 miles. In addition, this alternative would require about 400 acres of land, including 150 acres of cropland, 100 acres of grassland pasture, and 150 acres of upland woods in the Agassiz beach ridge area. Accordingly, this alternative has unacceptable impacts on wildlife habitat, lacks necessary economic feasibility, and is socially unacceptable.

Structural Alternatives

6.11 Structural measures applicable to the flood problems along the Snake River below Warren include: levee and floodway system, channel modifications, diversion channel, upstream reservoir storage, and clearing and snagging.

6.12 Alt. 6 - Levee and Floodway System - Alternative 6 would be a floodway system formed primarily by levees along both sides of the Snake River from just below Warren to the mouth. The floodway width between levees would range from 500 feet through the flatter downstream reach (mile 0 to mile $23^{\pm}$) to 400 feet in the steeper upper reach (mile $23^{\pm}$ to mile $48^{\pm}$). Levee heights would range from 5 feet to 7 feet, and the side slopes would be 3 on 1. The base widths of the levees would vary from 40 feet to 52 feet. The levees would contain the 10-year flood and more frequent floods with about 2 feet of freeboard.

6.13 The flanking levees required with this plan would inclose about 1,700 acres of river corridor, including approximately 1,000 acres of bottomland woods, 300 acres of pastureland, and 400 acres of cropland. The levees would be constructed on about 580 acres of adjacent cropland. Approximately 5 acres of wooded area at the upstream and downstream ends of the levee system would have to be cleared for the levee right-of-way.

In addition to the cropland affected, approximately 30 farmsteads would have to be relocated at least partially to provide the necessary levee alignment and right-of-way. Alternative 6 would benefit about 20,000 acres of farmland by reducing total estimated average annual damages by about 54 percent. Remaining average annual damages would be approximately $237,000. This alternative is the most expensive structural alternative considered with an estimated first cost of $16.5 million.

6.14 Alternative 6 has a benefit-cost ratio of 0.20 and thus lacks economic feasibility by a wide margin. In addition, removal of 580 acres of highly productive cropland from production and relocation of 30 farmsteads and residences would be unacceptable to local interests.

6.15 Alternative 6 would provide some net environmental benefits to biological systems because the required agricultural lands would be maintained as grassed floodway and levee slopes and because significant clearing of existing natural wooded and brushy habitat in the floodway would not be required. The net biological benefit would be enhanced by planting native prairie grassland species in lieu of the standard mixture of brome and bluegrass formerly used. Alternative 6 would also allow some continued natural recovery of aquatic biological systems along the "ditch." However, development of woody vegetation immediately adjacent to streambanks (where it performs a variety of significant biological functions) would be precluded because of floodway channel maintenance requirements.

6.16 Alt. 7 - Channel Modifications - With this plan, the channel of the Snake River would be enlarged to contain the 10-year (10-percent chance) and more frequent (i.e., less severe) floods. The extent of channel enlargement depends upon the slope of the river channel. In the flatter downstream reaches of the river (mile 0 to mile 23), a channel with a 90-foot bottom width would be required; and, in the upper reach (mile 23 to mile 46), a channel with a 20-foot bottom width would be needed. Along with numerous side ditch inlets, a drop inlet structure would be required at the confluence of the Snake and Middle Rivers. Extensive slope protection would be provided at the drop inlet structure, side ditch inlets, and all bridges crossing the modified channel. Review of the available bridge data disclosed that one bridge would have to be replaced to provide adequate flow capacity. Alternative 7 would need about 750 acres of cropland and 450 acres of natural habitat consisting of woods and brush along the river corridor. Losses of lowland woods habitat would decrease wildlife values of the area, which are already limited. Adverse impacts would also occur due to the destruction of woodland.

6.17 Alternative 7 lacks economic feasibility; its average annual benefits and costs estimated at $258,000 and $962,000, respectively, result in a benefit-cost ratio of 0.27. The plan would alleviate about 54 percent of the total flood damages along the Snake River below Warren, including about 45 percent of the agricultural crop damages. Average annual flood damages of $237,000 would still occur in the study area.

6.18 Alt. 8 - Diversion Channel to Red River of the North - Alternative 8 consists of a 6.8-mile diversion channel from the Snake River (upstream from Alvarado at mile 35) to the Red River of the North (mile 273.5). The diversion would consist of a channel about 12 feet deep, with a bottom width of 14 feet, five new bridges, flow control structures at the inlet and outlet ends of the diversion, and side ditch inlets at each road crossing and at intersections with existing watercourses. Alternative 8 would require about 325 acres of land (310 acres of cropland and 15 acres of bottomland woods).

6.19 This alternative would contain the 10-year (10-percent) and more frequent (less severe) floods and would benefit about 10,000 acres of agricultural land. The total annual damages would be reduced by about 49 percent, with about $434,000 in remaining average annual damages. Estimated first costs for the alternative are $3,400,000, with average annual benefits and costs of $61,000 and $279,000, respectively. Because the benefit-cost ratio is only 0.22, this plan lacks economic feasibility.

6.20 Of the structural alternatives investigated, this alternative would have the least detrimental biological effects. The natural habitat disturbed by this plan would consist of 15 acres of bottomland hardwoods at each end of the diversion. A wildlife corridor could be created along the diversion channel by planting the channel and the dredged material banks with a native prairie grassland species and by maintaining the channel as a grassed floodway. Rows of trees, planted parallel to the channel (to serve as windbreaks to prevent the channel from becoming filled with snow) would provide additional wildlife habitat.

6.21 In sum, alternative 8 could have some favorable effects on wildlife habitat; however, its lack of economic feasibility and the social impacts associated with the removal of 310 acres of cropland from production render it unacceptable.

6.22 Alt. 9 - Three Upstream Reservoirs - This alternative would involve construction of three small reservoirs on the Snake River and South Branch of the Snake River upstream from Warren. One reservoir would be on the Snake River at about mile 77, and the other reservoirs would be on the South Branch at approximately mile 15 and mile 22. The total surface area of the conservation pools would be 460 acres, and the design flood pools would be about 3,450 acres. Although flood control storage of these reservoirs would be approximately 15,000 acre-feet, 11,500 acre-feet of this total would be provided by the upstream site on the South Branch of the Snake River.

6.23 This alternative would require about 3,500 acres of land, including 300 acres of cropland, 80 acres of pastureland, 160 acres of bottomland woods, and 2,960 acres of wetlands. The conservation pools of the reservoirs would inundate 460 acres of land, including 160 acres of bottomland woods and 300 acres of wetlands. The remaining 3,040 acres would be subject to short-term inundation during periods requiring floodwater storage.

6.24 This alternative lacks economic feasibility with average annual benefits and costs estimated at $114,000 and $1,170,000, respectively, representing a benefit-cost ratio of 0.10. Average annual flood damages of $381,000 would still be present in the Snake River basin.

6.25 Biological effects of this alternative would include a decrease in wildlife habitat due to permanent inundation of 460 acres of habitat. Hunting opportunities for deer and upland game would suffer due to loss of habitat; however, waterfowl habitat would increase substantially due to maintenance of a conservation pool in the larger reservoir.

6.26 Alt. 10 - Clearing and Snagging (Both With and Without Shelterbelts) - With this alternative, the lower 50 miles of the Snake River would be cleared and snagged of fallen timber and other debris obstructing the natural free-flowing capacity of the existing channel. Except for the reach of river through Warren (river mile 48 to river mile 51), the river upstream from mile 20 has not been previously cleared. Work in the lower reach of the river, from the mouth to river mile 20, would consist of debris removal only, because this reach was cleared and snagged by the Middle River-Snake River Watershed District in 1969 and 1970. This work was funded by the State of Minnesota and the U.S. Office of Emergency Preparedness following the 1969 flood. From river mile 20 to river mile 50, all accumulations of debris and snags within 20 feet of the primary channel area would be removed.

6.27 The removal of standing timber and brush would be limited to the lower two-thirds of the channel bank to avoid significant effects on the canopy provided by the existing wooded corridor. The only standing trees to be removed beyond the lower two-thirds of the channel bank would be leaning trees that are in danger of falling into the river channel and causing a future flow obstruction. All vegetation which either helps maintain bank stability or provides fish and wildlife habitat but does not interfere with the natural unobstructed flow-carrying capacity of the channel would remain. The improved channel would be able to contain a 3-year (33-percent chance) flood.

6.28 Materials and debris from the clearing and snagging operation would be removed from the site and disposed of in the most environmentally acceptable way. All material would be stockpiled or disposed of by burial

or burning in a manner both agreeable to the local landowner and in compliance with Federal, State, and local regulations. Stockpiled material would be placed in a suitable location where it would not interfere with existing land-use practices but could be left as habitat for small animals.

6.29 At various points along the river where the wooded corridor is not continuous, the unprotected channel fills with snow and prevents full use of the channel capacity during initial spring runoff. To remedy this problem, rows of trees would be planted parallel to the river channel approximately 150 feet from the top of bank.

6.30 Of the plans investigated, this alternative is the only economically feasible damage reduction alternative. The average annual benefits would be $162,800 with the shelterbelt and $67,900 without the shelterbelt; average annual cost would be $28,300 and $58,500, respectively. The resulting benefit-cost ratios are 2.4 with a shelterbelt and 2.2 without one. These alternatives would provide substantial flood protection at the least cost and with the least requirement for additional agricultural land and natural habitat of the structural alternatives considered.

The National Economic Development and Environmental Quality Plans

6.31 The National Economic Development (NED) Plan, as described in the Principles and Standards for Planning Water and Related Land Resources Projects, is the proposed plan of snagging, clearing, and shelterbelts. The Environmental Quality (EQ) plan is also the proposed plan. As a result of shelterbelt construction, the plan makes net positive contributions to the environmental quality of the area, in terms of aesthetics, recreation, and habitat development.

7.00 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.01 The snagging and clearing aspect of the project would be a short-term flood damage reduction method if it is not properly maintained. The initial flood reduction benefits of this project are a reduction in area flooded and the possibility of making agricultural practices more timely.

7.02 The long-term effects of this project depend largely on maintenance activities. Maintenance of the clearing and snagging aspect of the project would result in the extended significant loss of habitat for fish, furbearers, birds, and turtles. This effect is brought about by the removal of vegetational regrowth and debris but it would also assure the growth of a healthy, efficient shelterbelt system. A maintained shelterbelt would develop at all horizontal and vertical strata. The long-term impact of this phase of the project would be an ever increasing effectiveness as a windbreak and the development of a habitat enhancing the value of the area for wildlife, as well as consumptive and non-comsumptive recreational use. The reduced flooding region would have no effect on vegetational productivity.

7.03 The long-term effects on the recreational status of the river are difficult to assess. Recreational possibilities of the river should increase with the growth and maturity of the shelterbelts. The cleared and snagged area would be visible for many years and the loss of vegetation would be noticeable and undesirable to many people.

8.00 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION

8.01 The natural resources (gasoline, etc.) used to construct and maintain the project would be irretrievable.

9.00 COORDINATION

9.01 Coordination with Federal, State, and local interests was an important part of this study. The U.S. Fish and Wildlife Service, Minnesota Department of Natural Resources, Soil Conservation Service, Minnesota State Planning Agency, and Middle River-Snake River Watershed Advisory Board, Minnesota Historical Society, National Park Service, Minnesota Department of Transportation, City of Warren, and City of Alvarado have contributed information, advice, and alternative plans.

9.02 The following agencies, interest groups, and individuals were furnished copies of the draft environmental impact statement for review:

Hon. Albert Quie, Governor of Minnesota
Hon. Dave Durenberger, U.S. Senate
Hon. Rudy Boschwitz, U.S. Senate
Hon. Arlan Stangeland, U.S. House of Representatives
U.S. Environmental Protection Agency
U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Department of Energy
U.S. Department of Health, Education, and Welfare
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
U.S. Department of Transportation
Advisory Council on Historic Preservation
Minnesota Department of Agriculture
Minnesota Department of Economic Development
Minnesota Energy Agency
University of Minnesota Department of Sociology/Anthropology
Minnesota Environmental Quality Board
Minnesota Senate, Natural Resources and Agriculture Committee
Minnesota House of Representatives
Minnesota State Archaeologist
Minnesota State Historical Society
Minnesota Pollution Control Agency
Minnesota State Planning Agency
Minnesota Department of Natural Resources
Minnesota Department of Health
Minnesota-Wisconsin Boundary Area Commission
Minnesota Water Resources Board
Minnesota Department of Transportation
Minnesota State Soil and Water Commission
State Office of Economic Opportunity
Midwestern Gas Transmission
Minnesota Department of Education
Mayor of Alvarado
Mayor of Warren
Mayor of Crookston
Mayor of Thief River Falls
Mayor of Argyle
Fork Township, Supervisor
Clerk, Oak Park Township
Middle River-Snake River Watershed District
Marshall County Highway Department
Wildlife of America
Water Resources Research Center
Minnesota Futurists
Friends of the Earth
Izaak Walton League of America
Ducks Unlimited
National Audubon Society
Minnesota Environmental Control Citizens Association
Minnesota Public Interest Research Group

Sierra Club
The Waterways Journal
Environmental Defense Fund, Inc.
Coalition on American Rivers
Minnesota League of Women Voters
Soil Conservation Society of America
Northwest Regional Development Commission
Soil Conservation Service Work Unit
Agricultural Stabilization and Conservation Committee
Snake River Advisory Committee
Center for Urban Affairs
Souris-Red-Rainy UMRBC
Aquar, Iyring, Whiteman, Moser, Inc.
Aerial Surveys, Inc.
Myhre and Jorgenson
Northwest Regional Development Commission
Crookston Daily Times
Thief River Falls Times
Warren Sheaf
William E. Olson
Harveydale Maruska
Melvin Peterson
Professor H. Paul Friesema, Northwestern University
Metropolitan Open Space Information Project
S. East Minnesota Area-Wide Planning Organization
The Nature Conservancy
Minnesota Waterfowl Association
Minnesota Pheasants Unlimited
Environmental Quality Council
Freshwater Biological Foundation
Minnesota Environmental Education Council
Minnesota Association of Conservation Education
Minnesota Environmental Education and Conservation Association
Minnesota Education Association
Environmental Science Center
Bell Museum of Natural History
Limnological Research Center
Water Resources Development Commission
Metropolitan Nature Foundation
Minnesota Conservation Federation
Ecological Society of America
Environmental Concern Organization
Environmental Concerns, Inc.
Wetlands Task Force
Minnesota Association of Watershed Districts
Marshall County Commission
Polk County Commission

9.03 Copies of this statement, in both draft and final forms, have been sent to the following libraries where they should be made available to the general public.

Minneapolis Public Library
Minnesota State Legislative Library
Environmental Conservation Library of Minnesota

Library of Congress
St. Paul Public Library
Metropolitan Council Library
University of Minnesota Library
Public Library, Thief River Falls
Public Library, Warren
Polk County Library

9.04 Single copies of this statement are available upon request from the St. Paul District Office, Corps of Engineers, 1135 U.S. Post Office and Custom House, St. Paul, Minnesota 55101.

BIBLIOGRAPHY

1. Burgess, R.L., W.C. Johnson, and W.R. Keammerer. 1973. Vegetation of the Missouri River Floodplain in North Dakota. North Dakota State University, Fargo, North Dakota. WI-221-018-73.

2. Hibbard, E.A. 1972. Vertebrate Ecology and Zoogeography of the Missouri River Valley in North Dakota. Ph.D. Thesis. North Dakota State University, Fargo, North Dakota. 216 pp.

3. Johnson, W.D. 1971. The Forest Overstory Vegetation of the Missouri River Floodplain in North Dakota. Ph.D. Thesis. North Dakota State University, Fargo, North Dakota. 151 pp.

4. Lane, Richard B. 1975. An Archaeological Survey of the Snake River from 2 Miles East of Warren, Minnesota to the Red River of the North August-November 1975. A Report Submitted to the U.S. Army Corps of Engineers, St. Paul District (Contract No. DACW37-76-C-0037).

5. Minnesota Pollution Control Agency. 4 Oct. 1975. Rules and Regulations, WPC 14.

6. Minnesota State Planning Agency. 1972. Land Management Information in Northwest Minnesota, Report 1.

7. U.S. Fish and Wildlife Service. 1979. Aquatic Resources of Minnesota Tributaries to the Red River of the North.

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LETTERS of COMMENT
and
CORPS RESPONSES

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST
CHICAGO, ILLINOIS 60604

SEP 11 1979

Colonel William W. Badger, District Engineer
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

RE: 79-049-194
D-COE-F36061-MN

Dear Colonel Badger:

We have completed our review of the Draft Environmental Impact Statement (EIS) for the proposed Snagging, Clearing and Shelterbelt development project for flood control on the Snake River, Minnesota. The proposed project would remove fallen trees and debris from the lower 50 miles of the river. In addition, shelterbelts would be planted at points on the north side of the river where the wooded corridor is not continuous.

Based on the information provided to us in the Draft EIS, we have no objections to the proposed project. Clearing and snagging is probably the least environmentally disruptive of any structural alternative that was assessed during the study; however, when compared to the non-structural alternatives, the recommended action will alter the present habitat and cause a reduction in fish and wildlife diversity. The potential loss of fish and wildlife has not been quantified in the Draft EIS, but it is suspected that the amount will not be significant.

In the Draft EIS, the numbers describing the remaining average annual flood damages and total flood damages reduction, as presented in Table 19 (page 43), do not agree with the figures given in the narrative portions of the alternatives analysis. During the preparation of the Final EIS, this apparent discrepancy should be resolved.

Prior to the start of construction activities, selective tree-marking operations and access-point selection will be completed. These activities should be coordinated with the U.S. Fish and Wildlife Service. Also, a detailed maintenance plan should be developed following completion of the clearing and snagging project.

Our comments are classified as LO-1. This means we do not have any objections regarding the environmental impacts of the proposed project and sufficient information is provided in the Draft EIS to evaluate the impacts of the alternatives. In accordance with U.S. EPA procedures, the date and classification of our comments will be published in the Federal Register.

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CORPS RESPONSE TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY

1. The discrepancy has been resolved. See Table 13, page 37.

We appreciate the opportunity to review and comment on the Draft EIS. Please send us two copies of the Final EIS when it is filed with U.S. EPA in Washington, D.C. Should you have any questions concerning our comments, please contact Jim Hooper of the Office of Federal Activities at (312) 353-2307.

Sincerely yours,

Barbara J. Taylor

Barbara J. Taylor, Chief
Environmental Impact Review Staff
Office of Federal Activities

54

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
NORTHEASTERN AREA STATE AND PRIVATE FORESTRY
370 REED ROAD — BROOMALL, PA 19008
(215) 596-1672

1950
September 25, 1979

Colonel William D. Badger
Department of the Army
St. Paul District, Corps of Engineers
135 U.S. Post Office & Custom House
St. Paul, MN 55101

Refer to: NCSED-EP
Draft Environmental Statement
Flood Control, Snake River, MN

Dear Colonel Badger:

We feel that any complete or large scale removal of trees and shrubs from the riverbank should be avoided. Woody vegetation reduces erosion of the banks more effectively than grass alone; since erosion is reduced, sedimentation downstream including the Red River, is reduced as well. If flooding should occur after clearing of these trees and before establishment of grasses, bank erosion could be severe. Streamside plants, combined with higher-growing plants, have water-holding capacity that tends to reduce run-off.

Thank you for the opportunity to review this Statement.

Sincerely,

DALE O. VANDENBURG
Draft Director
Environmental Quality Evaluation

CORPS RESPONSE TO U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE

There will not be complete or large scale removal of trees and shrubs from the riverbank. (Refer to Section 1.00.)

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

September 20, 1979

St. Paul District
Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Gentlemen:

We have reviewed the Draft Environmental Impact Statement for Snagging and Clearing for Flood Control, Snake River, Minnesota. We are responding on behalf of the Public Health Service.

We foresee no adverse health impact that may result from the proposed plan. We believe the proposed project is the most logical, and we acknowledge that it was chosen as both the National Economic Development Plan and the Environmental Quality Plan.

56 Regarding the access routes to the river channel which might have to be cleared because of the limited number of natural access points for areas requiring work (page 33), we suggest that a statement be made requiring that appropriate legal authorization, permission from land owners, and/or permits be received prior to making necessary access routes.

We appreciate the opportunity of reviewing this statement. Please send us a copy of the final statement when it becomes available.

Sincerely yours,

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Bureau of State Services

CORPS RESPONSE TO DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Section 205 of the Flood Control Act as amended and approved 23 October 1962 states that easements and rights-of-way are non-Federal responsibilities and are required of the local sponsor.

United States Department of the Interior

ER-79/810

September 24, 1979

Colonel William W. Badger
District Engineer
U.S. Army Engineer District
St. Paul
1135 U.S. Post Office & Custom House
St. Paul, MN 55101

Dear Colonel Badger:

We have reviewed the draft environmental statement (DES) and draft detailed project report for flood control on the Snake River, Marshall, Polk, and Pennington Counties, Minnesota. The following comments are provided for your consideration:

General Comments

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Mineral production in Marshall, Pennington, and Polk Counties is limited to lime and sand and gravel. We do not believe the proposed project would adversely affect mineral production in those counties.

No effects of the project upon units of the National Park System or involving the jurisdiction or expertise of the National Park Service have been identified during project review. The area under National Park Service administration nearest the site is Voyageurs National Park, 125 airline miles to the east.

We believe that the project will provide flood damage reduction benefits and yet be undertaken in a manner that should not create significant adverse impacts to fish and wildlife or fish and wildlife habitat along this 50-mile reach of the Snake River. We also believe that the 3-row shelterbelts (30-feet wide) also proposed along the various unprotected sections of the riverbank are an excellent project feature and the Corps should be commended for this effort. These shelterbelts should not only help to reduce snow accumulations and erosion and sedimentation in these areas but also provide food, cover, and a migrational corridor for wildlife. This is an area of Minnesota where agricultural clearing has eliminated or significantly reduced most of the natural wildlife habitat.

The primary impact of the project on fish and wildlife resources would be due to the loss of floodplain vegetation within the wetted portion and along the lower two-thirds of the primary bank. Clearing of the channel likely will result in increased snowmobile activity within the channel and adversely impact some wildlife species along this reach of the Snake River. In our opinion, however, the project should not have a degrading effect on this riverine floodplain area or have more than a minimal adverse impact on fish and wildlife in these area. Because of this, the project would comply with Executive Order 11988.

We suggest that one additional statement be included in the Final Environmental Impact Statement as follows: "The construction features and measures proposed should be adequately documented in the construction contract and fully understood and undertaken by the contractor(s)." The proposed construction techniques and equipment used (hand axes, snowmobiles, etc.) should also be addressed in the FEIS.

Specific Comments

Page 40, paragraph 4.38. The draft environmental statement (DES) states that there are nine sites which may be eligible for listing in the National Register. We urge the Corps to complete testing at these sites and request formal determinations of eligibility from the keeper of the National Register. We also recommend that the effects the project will have on these sites be more thoroughly analyzed and discussed. If the sites are determined eligible for the National Register and the impacts on them are adverse, the Corps should work with the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officer (SHPO) to provide acceptable mitigation measures.

We also suggest the Corps contact the Interagency Archeological Service, Heritage Conservation and Recreation Service, Midcontinent Region, P.O. Box 25387, Denver Federal Center, Denver, Colorado 80225, for assistance in discussing acceptable mitigation measures for any site to be affected by the project. The final environmental statement should contain any memorandums of agreement prepared in consultation with the SHPO and ACHP.

Sincerely yours,

David L. Jarvis
Regional Environmental Officer

CORPS RESPONSE TO THE U.S. DEPARTMENT OF THE INTERIOR

The nine sites which were recommended for further testing will not receive any further testing. It has been determined that all these sites can be avoided during clearing and snagging operations. Protective measures such as in-field site boundary identification will be undertaken to insure avoidance of these sites. This project will therefore have no adverse impact upon any of the 32 sites located during the 1975 cultural resources survey.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION 5
18209 DIXIE HIGHWAY
HOMEWOOD ILLINOIS 60430

September 20, 1979

IN REPLY REFER TO
HED-05

District Engineer
St. Paul District
Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Sir:

The draft environmental statement for the snagging and clearing for flood control, Snake River, Minnesota, has been reviewed and we find the highway system is not affected by the proposal. As a result, we have no comments to offer on the statement.

Sincerely yours,

Donald E. Trull
Regional Administrator

By: W. G. Emrich, Director
FOR Office of Environment and Design

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FEDERAL ENERGY REGULATORY COMMISSION
CHICAGO REGIONAL OFFICE
230 SOUTH DEARBORN STREET, ROOM 3130
CHICAGO, ILLINOIS 60604

September 24, 1979

Colonel William W. Badger
District Engineer
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Badger:

We have reviewed the Draft Environmental Impact Statement dated July 27, 1979, for the Snagging and Clearing for Flood Control, Snake River, Minnesota Our comments are made in accordance with the National Environmental Policy Act of 1969 and the August 1, 1973 Guidelines of the Council on Environmental Quality. Our principal concern with developments affecting land and water resources is the possible effect of such developments on potential hydroelectric developments and on natural gas pipeline facilities.

Since the above-noted proposed project apparently would pose no major obstacle to the construction and operation of such facilities, we have no comments on the Draft Environmental Impact Statement, and therefore do not request a copy of the final statement.

The foregoing statements are of this office, and therefore do not necessarily represent the views of the Federal Energy Regulatory Commission.

Thank you for the opportunity to comment on the Draft Environmental Statement.

Sincerely,

Lawrence F. Coffill

Lawrence F. Coffill
Regional Engineer

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Minnesota Pollution Control Agency

SEP 10 1979

Colonel William H. Badger
U.S. Army Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Attention: NCSED-ER

Re: Environmental Impact Statement and Detail Project Report for Flood Control on the Snake River
Warren, Minnesota

Dear Colonel Badger:

We have reviewed the referenced documents which you submitted to the Minnesota Pollution Control Agency under cover letter dated August 6, 1979 and we have the following comments regarding our position on your proposals.

1. You are well aware that the State of Minnesota and North Dakota have been involved in a series of negotiations regarding flood control in the Red River Valley. Flood impacts on the Red River should be extensively discussed before any action is taken. The project should only be undertaken in such a manner to as not to cause increased flood stages on the Red River of the North. We also feel that any action taken in the Red River watershed which may affect the State of North Dakota should be coordinated with that state.

2. The MPCA regulates the disposal of trees, stumps, and other such waste. Therefore, approval for the disposal of these materials must be obtained from the MPCA, Division of Solid Waste. If burning of the debris will be used as a disposal method, a permit from the MPCA, Division of Air Quality must be obtained.

3. We are concerned that the potential water quality impacts of the project have not been discussed in sufficient detail. It appears that there will be temporary and long term effects on siltation from the clearing and grubbing activity due to initial erosion and the subsequent change in the regime of the river. Effects on the water temperature and the aesthetic impacts of the tree removal should also be discussed in more detail.

Phone (612) 296-7225
[illegible]

CORPS RESPONSE TO THE MINNESOTA POLLUTION CONTROL AGENCY

1. Increased channel velocities would result in an earlier flood peak and a reduction in flood duration. This earlier Snake River peak would cause a minimal adverse impact on the Red River flooding downstream of the mouth of the Snake River.

2. Comment noted.

3. There would be a minimal, if not insignificant, impact on Water Quality. Shelter belts would reduce wind-blown channel siltation with a resultant effect of reduced turbidity. All grubbing activities would be limited to channel debris. Trees and stumps would either be left intact or cut flush with the ground. In all cases, channel stability would be of the highest priority. Some negative aesthetic impacts would result from tree removal, but these negative impacts would be offset by the positive effects of the shelterbelt plantings.

4. Maintenance of the project will be a local responsibility. The nature and extent of the maintenance should be carefully detailed to allow a careful evaluation of the total impacts of the project and to insure that local agencies understand their duties and responsibilities they will have under the proposed project. We are concerned whether the $15,000 annual maintenance cost reflects costs due to increased need for erosion protection or will that be an additional cost to local, State, or Federal agencies. We are also concerned that without proper maintenance the project will have a much shortened or nonexistent life expectancy.

If you have any questions regarding our position, please feel free to contact me or Mr. Louis Flynn of my staff at (612) 296-7225.

Yours truly,

Barry C. Schade
Acting Director
Division of Water Quality

BCS/LLF:cg

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CORPS RESPONSE TO THE MINNESOTA POLLUTION CONTROL AGENCY (CONTINUED)

4. Project maintenance, as specified under the Sec. 205 authority, is a local responsibility and would be conducted under the same constraints as the initial project construction.

STATE OF
MINNESOTA
DEPARTMENT OF NATURAL RESOURCES
CENTENNIAL OFFICE BUILDING • ST. PAUL, MINNESOTA • 55155

FICE OF THE
MMISSIONER
·12) 296-2549

November 2, 1979

Colonel William W. Badger, District Engineer
St. Paul District, Corps of Engineers
1135 U. S. Post Office and Custom House
St. Paul, Minnesota 55101

Re: NCSED - ER, DEIS and DPR for Snake River Snagging and Clearing Proposal

Dear Colonel Badger:

The Department of Natural Resources has reviewed the Draft EIS and the Detailed Project Report (DPR) for the proposed Snake River snagging and clearing project and offers the following comments.

Our primary concern is that neither the DEIS or the DPR discuss the possible adverse effects of this project on downstream flood flows. There is a great deal of ongoing public and agency concern regarding activities which increase flood flows and result in damage to structures and agricultural land along the Red River.

The report states on page H-9 that the channel capacity from river mile 21.2 to Warren will increase from 600 cfs to 900 cfs or 50%. It is also stated on page H-12 that channel velocities will increase up to 16%, which is considered insignificant in terms of erosion potential.

The report also states on page H-12 that "County and judicial outlet ditches have been cleaned out and improved only to a limited extent because of a lack of adequate major outlets. The Middle River-Snake River Watershed District has made a study of needed improvements in the watershed and the improvements are expected to be installed as the main channels of the Middle and Snake Rivers are improved". Therefore, not only will this project have the potential for increasing flood flows downstream, it will have the added impact of encouraging the improvement of the existing drainage system since the main channel will now be able to handle it.

We request that the Corps look into these possible impacts and discuss them in the final documents, including an analysis of the downstream damages that could result and how this affects the benefit-cost ratio. Some of the benefits claimed are not true benefits if flood damages are merely transferred from one location to another.

We hope these comments will be useful in your preparation of the final EIS and report.

Yours truly,

Joseph N. Alexander

CORPS RESPONSE TO THE MINNESOTA DEPARTMENT OF NATURAL RESOURCES

Increased channel velocities would result in an earlier flood peak and a reduction in flood duration. This earlier Snake River peak would cause a minimal adverse impact in the Red River flooding downstream of the mouth of the Snake River.

Minnesota State Planning Agency
101 Capitol Square Building
550 Cedar Street
St. Paul, Minnesota 55101
Phone 296-8254

August 28, 1979

Colonel William W. Badger
St. Paul District Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, MN 55101

RE: NCSED-ER

Dear Colonel Badger:

We have reviewed the Draft Environmental Impact Statement on Snagging and Clearing for Flood Control, Snake River, Minnesota, which you furnished us with your letter of July 27, 1979.

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1. The project would involve using the river channel as a base of operations for clearing and snagging activities. However, as discussed in Paragraph 4.05 on page 33, the winding nature of the river channel, particularly between Warren and Alvarado, would present a problem in confining the movement of construction equipment within the channel; and, in addition, access routes to the river channel might have to be cleared because of the limited number of natural access points for areas requiring work.

2. The Draft EIS fails to adequately describe the nature of such access routes and discuss their potential environmental effect and possible mitigating measures. Such a discussion should also be included for access routes that may be needed for shelterbelt planting proposed for April or May.

Thank you for the opportunity to provide comments on this project.

Sincerely,

Charles R. Kenow

Charles R. Kenow, Acting Manager
Program Analysis & Project Evaluation

CRK:GH/pb

cc: Tom Balcom

CORPS RESPONSE TO MINNESOTA STATE PLANNING AGENCY

1. Paragraph 1.14 has been added and reads: Identification of trees to be removed, access points, disposal areas and access points for shelterbelt planting would be done during a pre-construction marking operations by the Corps of Engineers. This operation would be conducted during the late fall when logistics problems are at a minimum. It would insure that the removal of trees and shrubs, and the ecological impacts, are kept at a minimum.

2. See paragraph 1.14.

Minnesota
Department of Transportation
Transportation Building
St. Paul, Minnesota 55155

Office of Commissioner

(612) 296-3000

September 18, 1979

Colonel William W. Badger
District Engineer
Corps of Engineers
Saint Paul District Office
1135 U.S. Post Office and Custom House
Saint Paul, Minnesota 55101

In Reply Refer To: 702
Snagging and clearing for flood control
Snake River, Minnesota
Draft Environmental Impact Statement

Dear Colonel Badger:

65 The Minnesota Department of Transportation has reviewed the draft environmental impact statement prepared by the Corps of Engineers for flood control on the Snake River in Minnesota. The proposed action is not anticipated to impact any existing or proposed facilities under the jurisdiction of our department. However, we wish you to note the proposed replacement of Bridge No. 6971 on Trunk Highway 210 over the Snake River, 1 mile south of Alvarado, Minnesota. The letting of the construction contract for this project is scheduled for November 1979.

Thank you for the opportunity to review this report. If you have any questions please contact Randy Halvorson, Office of Environmental Affairs, at (612)296-1636.

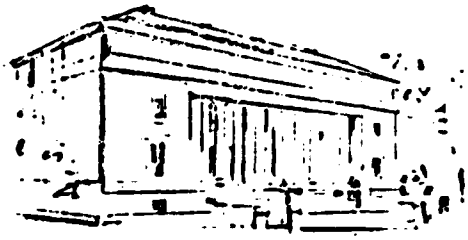
Sincerely,

Richard P. Braun
Commissioner

CORPS RESPONSE TO MINNESOTA DEPARTMENT OF TRANSPORTATION

Comment noted.

TECHNICAL APPENDIX



MINNESOTA HISTORICAL SOCIETY

690 Cedar Street, St. Paul, Minnesota 55101 • 612-296-2747

15 March 1976

Colonel Forrest T. Gay, III
District Engineer
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Attention: Permit and Statistics Branch

Dear Colonel Gay:

RE: NCSED-ER
Cultural Resources Report
Snake River, Minnesota,
Flood Control Project

On page 36 of the report described above the author, Mr. Richard Lane, lists nine sites which meet National Register criteria. These sites should undoubtedly receive the close attention of the Corps of Engineers as planning for the area continues, including, if necessary, proper mitigative measures. Mr. Lane also discovered, in the short time given him to prepare the survey, nine sites which should be analyzed in greater detail to determine their eligibility for the National Register. These nine sites are listed on pages 35 and 36 of his report. I hope that Mr. Lane's suggestions will be accepted and that these nine sites will receive the attention he requests.

Thank you for your attention to historic and archaeological resources in this project.

Sincerely,

Russell W. Fridley

Russell W. Fridley
State Historic Preservation Officer

RWF/fr

Exhibit 1

United States Department of the Interior
NATIONAL PARK SERVICE
INTERAGENCY ARCHEOLOGICAL SERVICES - DENVER
OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION
1978 SOUTH GARRISON - ROOM 107
DENVER, COLORADO 80227

IN REPLY REFER TO:

H22-(RMR)PI

APR 2 2 1976

Mr. Roger G. Fast
Chief, Engineering Division
Acting District Engineer
Department of the Army
St. Paul District, Corps of Engineers
1135 U. S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Mr. Fast:

The following comments are offered in regard to the adequacy of the report entitled: "An Archaeological Survey of the Snake River From 2 Miles East of Warren, Minnesota to the Red River of the North, August - November 1975" submitted by Richard B. Lane.

The fieldwork appears to have been carefully conducted and the sites well described from their surface features. However, the subsurface testing data, including stratigraphic profiles, should also have been included in the report. Further, the site mitigation recommendations appearing in Appendix C lack justification and thus lessen their creditability. Also, the sites should be evaluated for eligibility to the National Register of Historic Places and appropriate mitigative measures formulated for those sites determined to be of National Register quality.

Thank you for the opportunity to comment on this report, and we would appreciate being kept informed of subsequent phases of work involving cultural resource mitigation in the Marshall-Red River Flood Control Project.

Sincerely yours,

Jack R Rudy
Chief, Interagency
Archeological Services - Denver

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

IN REPLY REFER TO:
AFA-SE

SEP 5 1979

Colonel William D. Badger
District Engineer
U. S. Army Engineer District
St. Paul
1135 U. S. Post Office
and Custom House
St. Paul, MN 55101

Dear Colonel Badger:

Per your letter dated August 24, 1979, NCSED-ER, we have received the Environmental Impact Statement for the Small Flood Control Project on the Snake River at Warren, Minnesota. We concur with the findings that the project will not adversely affect any Federally listed endangered or threatened species. Therefore, it is my biological opinion that the project, as currently planned, will not jeopardize the continued existence of any Federally listed species. There is no critical habitat currently designated in the vicinity of the project.

This letter provides comment only on the endangered species aspect of the project. Comments on other aspects of the project under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.) may be sent under separate cover.

Sincerely yours,

Charles A. Hughlett

Charles A. Hughlett
Acting Regional Director

Exhibit 3